Foods

27

AUSTRALIAN SCIENCE EDUCATION PROJECT

Foods begins with a section called Food and Energy. It also contains six other sections called options. After you have finished Food and Energy, you can choose from the options.

As you work through *Foods* you can keep information and drawings in a notebook. The symbol ✍ tells you when to record something in your notebook.

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HIGH SCHOOL
TEXT BOOK
CESSNOCK

11740/73–(204 SB)–1

Food and Energy

DIFFERENT EATING CUSTOMS

In some Maori tribes the men were not allowed to touch food on certain days of the year.

Different foods are eaten by different groups of people. Why do people differ in their eating customs? Is it just a matter of habit, or are there other reasons?

Different religious beliefs influence eating customs. For example, some Jewish people do not eat pork and some Hindus do not eat beef. At one time Roman Catholics were not allowed to eat meat on a Friday. Many Catholic people still eat only fish on Friday. You can probably think of other examples of food customs due to religious beliefs.

Some foods are associated with religious festivals. For instance, despite Australia's hot summer, the traditional Christmas fare of stuffed turkey, plum pudding and brandy sauce is often eaten. Coloured eggs and chocolate Easter eggs are eaten and given as presents. Pancakes are often eaten on Shrove Tuesday.

Eating is also a part of many social occasions. The photo of the barbecue on page 2 is a typical example. Weddings, birthdays, christenings and the return of a friend are all occasions which may be celebrated with food and drink.

Food customs differ a great deal from one country to another. For example, people in France and Japan have quite different eating habits.

The French and Japanese not only eat different foods, but the way the foods are prepared and the order of eating them also differs. They use different utensils and have a different arrangement of dishes. The way each group eats and the setting in which they eat are not the same.

Look at the photos of people eating Japanese and French meals.

Record in your notebook the differences between Japanese and French eating. Try to say something about each of the following:

☐ the foods being eaten (include drinks),
☐ how the food has been prepared,
☐ how the table is arranged,
☐ what utensils are being used,
☐ how the utensils are arranged,
☐ the way the people are seated.

Make an additional note on how religion and social occasions affect eating customs. (Review page 4 if you have difficulty with this question.)

You have seen how groups of people have been influenced in their eating by custom and religious belief. However, the variety of foods eaten by each group keeps the people healthy. This is because the foods contain all the substances required to keep the body healthy. In the next section you will look at what these substances are.

Dining out French style. *(La Popotte Restaurant, Melbourne.)*

Sitting down to a Japanese meal. *(Sukiyaki Restaurant, Melbourne.)*

SUBSTANCES IN FOOD

There is a variety of substances found in all foods. Most substances are useful in keeping us healthy but each does so in a different way.

One substance in all foods is **water**. Plums, for example, contain about 86 per cent water–that is, every 100 grams of plums contains 86 grams of water. Even prunes (dried plums) contain about 24 per cent water–that is, every 100 grams of prunes contains 24 grams of water.

In cucumbers or lettuce the amount of water can be as high as 95 per cent, but most foods have much less than this.

Most of the dry matter in foods is made up of **carbon compounds.*** These are of three main kinds:

- ☐ **carbohydrates**
- ☐ **fats and oils**
- ☐ **proteins.**

Equally important, but found in smaller quantities, are:

- ☐ **mineral salts**
- ☐ **vitamins.**

Thus, the main substances in food are water, the three main kinds of carbon compounds, mineral salts and vitamins.

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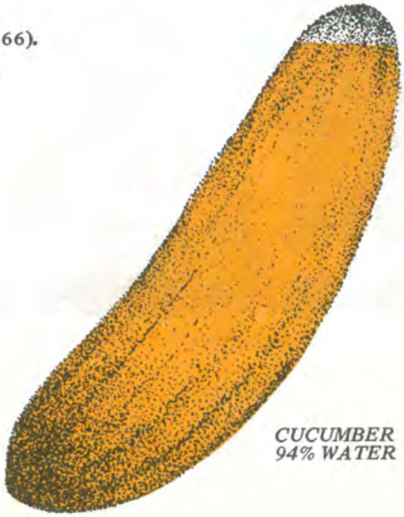
* Words which are underlined are in the Glossary (pages 64–66).

PLUM
86% WATER

PRUNE
24% WATER



CUCUMBER
94% WATER

CARBOHYDRATES

Carbohydrates are found in many common foods for example, they are present as starch in bread and potatoes, and as glucose in onions and fruits. You can find out the amount of carbohydrates in some foods from the tables on pages 67 to 75.

Each carbohydrate is made up of many small particles which are all the same. These particles are called **molecules**. Each molecule is made up of many smaller particles, which may be different, called atoms.

All carbohydrate molecules contain atoms of carbon, hydrogen and oxygen.

The 'hydrate' part of the word carbohydrate means water. Note that in all carbohydrates, as in water, there are two hydrogen atoms for each oxygen atom.

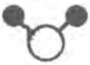


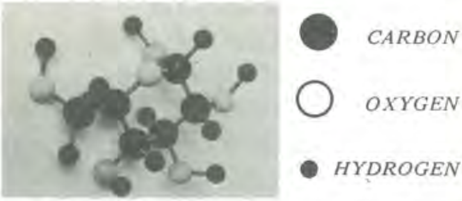
Diagram of atoms in a water molecule.

Carbohydrates are used by the body to supply energy for warmth, movement and growth. They are not the only foods that give energy but they are the main ones in the human diet. You can see this from the food tables on pages 67 to 75.

In your notebook, note how to recognize a carbohydrate molecule, and what carbohydrates supply to the body.

Sugars

One well known sugar is glucose, or grape sugar. Here is a model of the arrangement of atoms in a glucose molecule:



Notice that there are twice as many hydrogen atoms ● as oxygen atoms ○ –just as in water.

The glucose molecule can be illustrated simply as ⬡

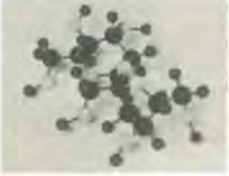
Another well known sugar is sucrose, or table sugar. It is obtained by crushing sugar cane.

The sucrose molecule can be illustrated simply as two glucose units.

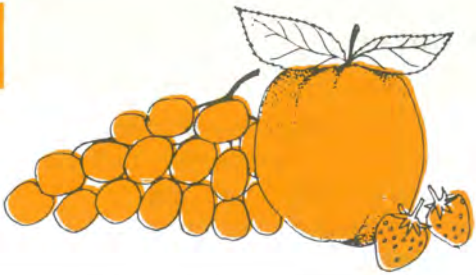
⬡⬡

Glucose and sucrose have small molecules. They taste sweet and are the most common sugars in food. All ripe fruits contain at least one type of sugar.

Does the photo below show a carbohydrate molecule? (If you don't know, look back over what you've just read.)



ACTIVITY 1: A TEST FOR GLUCOSE

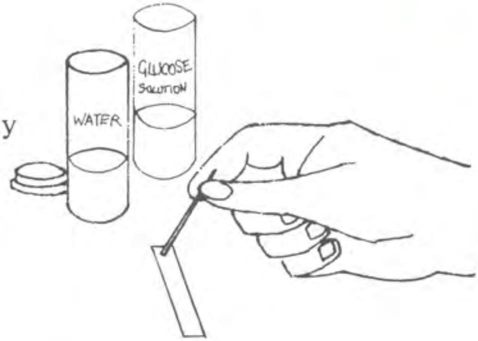


You will need:

- glucose solution
- water
- Testape, 2 cm length
- 1 toothpick.

Dip the broad end of the toothpick into the water and spot one end of the Testape with the wet toothpick.

Note any colour change. This may take up to one minute to appear.



Compare what happens when you spot the other end of the Testape with the glucose solution.

✍ In your notebook, write a summary of the test for glucose. Be sure to describe the colour change.

✍ Illustrate the two most common sugars found in foods.

Starches

In addition to sugars, starch is the other main kind of carbohydrate food that provides energy for the body.

Starch is found in cereals such as wheat and maize. Foods made from these grains, for example bread and cake, are starchy foods. Potatoes also have a lot of starch.

Starch is a carbohydrate with a big molecule which is composed of many glucose units. Starch molecules can be illustrated as shown below.

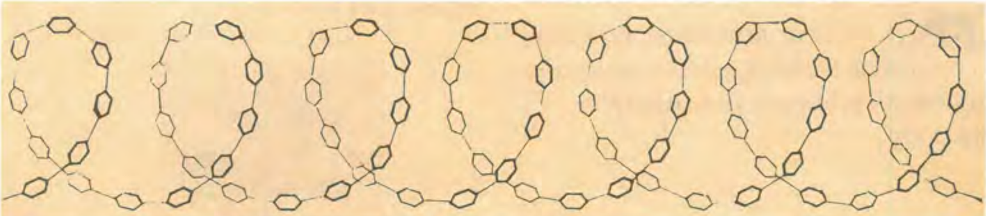
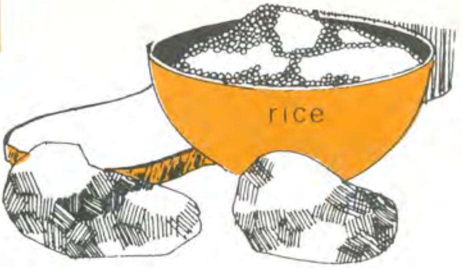


Diagram of part of a starch molecule.

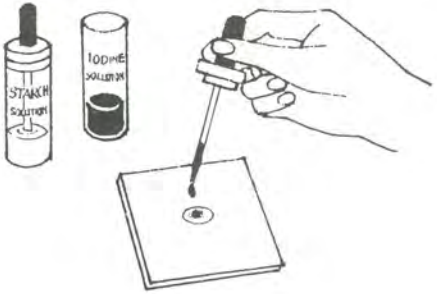
ACTIVITY 2: A TEST FOR STARCH

You will need:
- starch solution
- glucose solution
- 1 white tile
- iodine solution
- 3 droppers.



Put a few drops of the starch solution on the tile.

Add a few drops of iodine solution. Be careful to avoid touching the starch solution with the dropper containing the iodine solution.



Now repeat these steps, using the glucose solution instead of the starch solution.

What happened when you added the iodine solution to the starch?

What happened when you added the iodine solution to the glucose?

How do you know whether starch is present in a food? Write a summary describing the test for starch.

List some starchy foods and then illustrate a starch molecule.

Cellulose

Cellulose is the main substance in the cell walls of plants. It is another carbohydrate with large molecules. The molecules are composed of glucose units and can be illustrated as shown below.

Most cellulose is not digested and is part of what is known as **roughage.**

Roughage in the diet is important as it helps to prevent constipation. Roughage forms part of the faeces.

Note the kind of food that contains cellulose, its value in our diet, and how it can be illustrated.

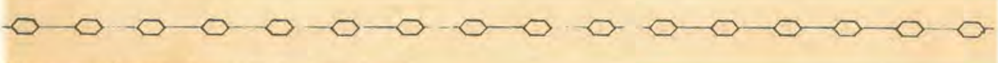
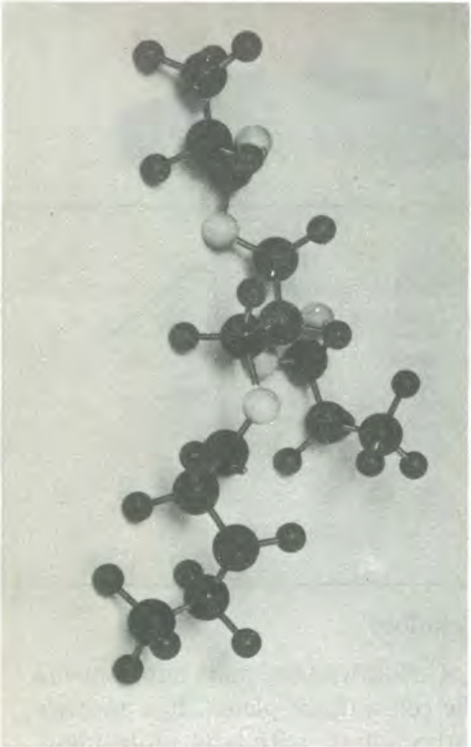


Diagram of part of a cellulose molecule.

FATS AND OILS


The arrangement of atoms in an oil molecule.

Most foods contain some fat or oil. Foods with a high proportion of fat or oil are margarine, milk products, fish and nuts.

You can find out the amount of fats or oils in some foods from the tables on pages 67 to 75.

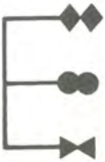
Fats and oils are similar substances. For example, they taste much the sam One obvious difference is that most fats are solid at room temperature, but oils are liquid. For example, dripping melts when heated, but turns solid when it cools again.

You could try putting some cooking oil into the freezer of a refrigerator to see if it turns solid.

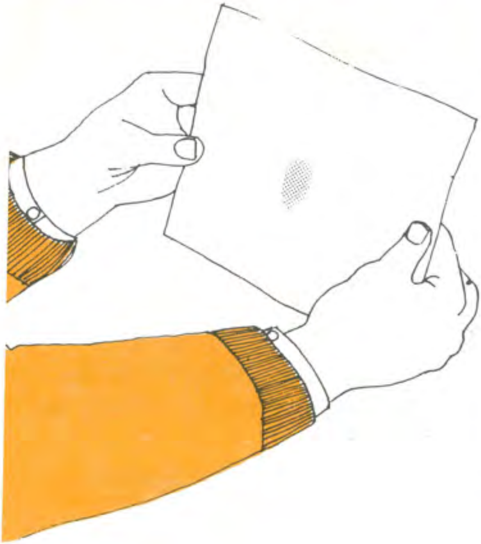
Like carbohydrates, fats and oils are used by the body to supply energy for warmth, movement and growth. For the same mass, fats contain much more energy than carbohydrates–but generally we get most of our energy from carbohydrates because we eat more of them.

Fats contain the same types of atoms as carbohydrates. But carbon, hydrogen and oxygen atoms are combined in a different arrangement, and in different numbers.

Fat and oil molecules can be illustrated as:



ACTIVITY 3:
A TEST FOR FATS AND OILS



If you want to find out whether a food contains any fat or oil, just smear the food on to a piece of brown paper. If fat or oil is in the food, a shiny grease spot will remain on the paper. You can see the grease spot by holding the paper up to the light.

Sometimes water will make a spot on paper too, but it does not look greasy and will dry out. A grease spot stays there.

✎ In your notebook, write a summary of the test for fats and oils.

✎ Note why fats are important in our diet and the simple way of illustrating a fat or oil molecule.

ALASKAN MEAT SUPPLY
....and not too much lean meat.

PROTEINS

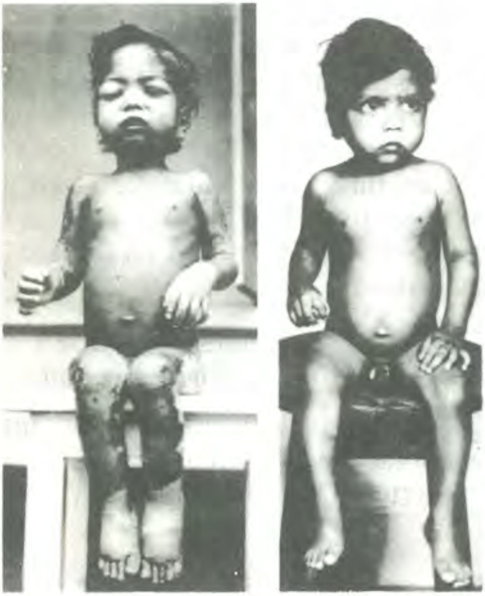
Besides carbohydrates and fats and oils, proteins are another type of carbon compound found in foods. Large amounts of proteins are found in meat, eggs and cheese. You can find the amount of protein in some foods from the tables on pages 67 to 75.

Proteins provide the raw materials for growth. Some are changed in the body into new proteins that become part of the body structure. Others are broken down. One of the substances eventually produced from this breakdown is **urea**. Urea is a waste substance and is eliminated from the body in the urine.

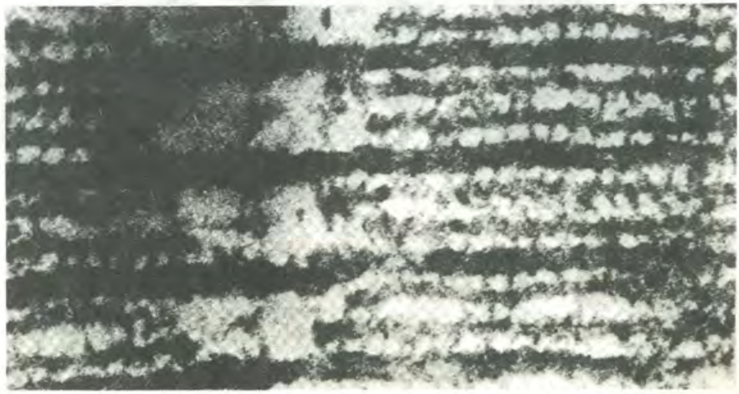
When proteins are broken down, energy is supplied to the body.

In many parts of the world people do not get enough protein in their diet. A shortage of protein during childhood can cause permanent damage to the body—for example, damage to the brain.

You could read more about protein diets in Option 5 (Regulating the Diet), page 52.



These two photos are of the same boy. The photo at left was taken when the boy was suffering from protein **deficiency**. *The other photo was taken after he had been fed a protein-rich diet for 30 days.*
(Photo by courtesy Dr H.A.B. Parpia.)



The dark lines you can see in this photo of muscle are giant protein molecules.
(Photo by courtesy Dr H.E. Huxley.)

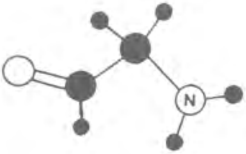
Proteins are chemicals made by iving things. There are proteins in every cell of every plant and animal.

Proteins are giant molecules. Even so they are still so small that they can only just be seen with a powerful **electron microscope**.

Many different proteins take part n the enormous variety of chemical changes that occur in living things.

Protein molecules contain carbon atoms ● , hydrogen atoms •, oxygen atoms ○ , nitrogen atoms Ⓝ, sulphur atoms Ⓢ and phosphorus atoms Ⓟ. Other kinds of atoms can also be included.

The big protein molecules are made up of smaller molecules called **amino acid** molecules.



The diagram above shows the arrangement of atoms in one amino acid molecule.

It is these amino acid molecules that are recombined during growth to make new protein molecules.

What **elements** do proteins contain that carbohydrates, fats and oils do not have? Write the answer in your notebook.

When many amino acids combine to form a protein, the protein molecules can be represented as shown at the bottom of this page.

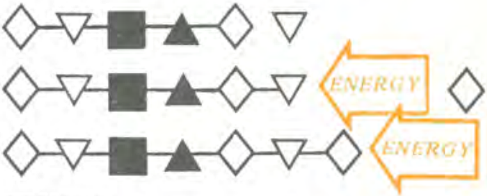
Different amino acids can be simply illustrated as:

◆ ▽ ■ ▲ ◇

As a protein is made up of different amino acids, part of a protein can be illustrated by symbols such as:

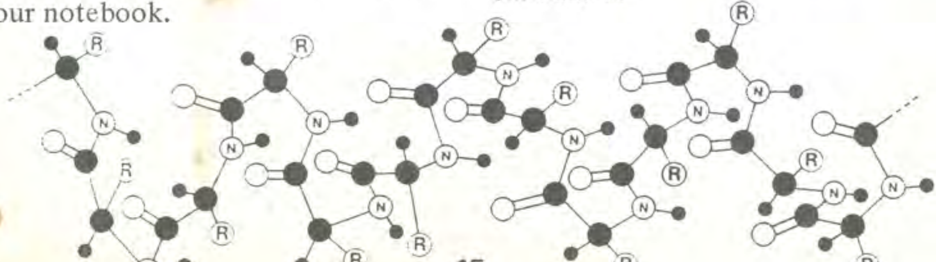
◆—◆—◇—▽—■—▲—◇

Amino acids from proteins can be recombined in the cells to form new proteins. The building of new proteins requires energy. (The process of energy supply is discussed on page 22.)



In your notebook, note the two main uses of proteins and show how amino acids and proteins can be simply illustrated.

This protein molecule is bigger than it seems. The symbol R represents a chain of carbon and hydrogen atoms together with some sulphur, phosphorus and other atoms.



ACTIVITY 4: A TEST FOR PROTEIN

You will need:
- 2 microscope slides
- 1 burner
- **Millon's Reagent**
- protein solution
- water
- 1 wooden peg
- 3 droppers.

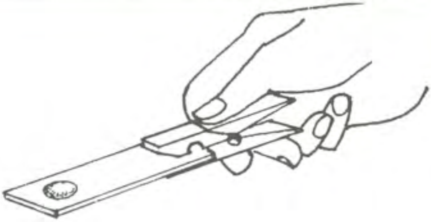
WARNING
Be careful with the Millon's Reagent.

Place two drops of protein solution on one end of the microscope slide.

Add one drop of Millon's Reagent to the drop of protein solution on the slide.

What happens?

Warm the slide with a small flame. Do not hold the slide close to the flame–it could crack.



Now repeat this procedure using water in place of protein solution.

Write a summary of the protein test. Note any changes, including colour changes.

VITAMINS

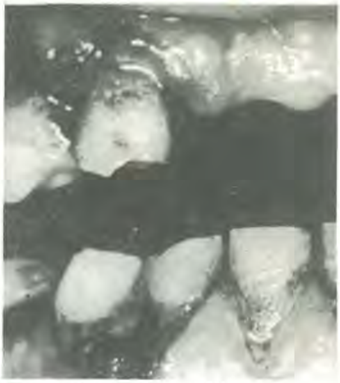
All the food types you have tested so far can be used by the body to supply energy. Proteins also upply the raw materials for growth. Vitamins, however, are not an energy source but the body could not function properly without them.

For example, sailors often used to suffer from scurvy. This disease is caused by a lack of vitamin C n the diet.

Refrigerators were not known 200 years ago, and so preserved food (which did not contain vitamins) was fed to sailors on long voyages. Fresh fruit and vegetables were eaten rarely on these voyages. The problem was overcome by giving sailors a daily ration of lime juice. This is how British sailors came to be given the nickname 'limeys'.

Other ailments, like scurvy, are overcome if the correct vitamins are available in the diet.

You can find the amount of vitamin C in some foods from the tables on pages 67 to 75.



Gum disease caused by a lack of vitamin C.

(Photo by courtesy of Department of Oral Medicine and Surgery, University of Melbourne.)

ACTIVITY 5: A TEST FOR VITAMIN C

You will need:

- vitamin C solution
- 2 microscope slides
- DIP solution
- 1 glass rod
- 2 droppers.

Put two drops of the DIP solution on one of the microscope slides.

Add the vitamin C solution drop by drop to the DIP solution on the slide. Stir gently with the glass rod. (Keep adding vitamin C drops until you notice a change.)

Add one drop of water to the other slide and test in the same way.

Record what you observe in your notebook.

Make a note on the importance of vitamins in the diet. Note that they do not supply energy.

MINERAL SALTS

By the colour of his face, he needed the iron

In addition to vitamins, small amounts of mineral salts such as calcium and iron salts are also required in the diet.

All foods contain some mineral salts. You can find the amounts of calcium and iron in some foods from the tables on pages 67 to 75.

Lack of mineral salts in the diet may cause some ailments. For example, lack of iron in the diet results in the disease called **anaemia**.

An anaemic person is often listless and pale. This is because iron from iron salts is required for the manufacture of the blood protein called **haemoglobin**. Haemoglobin is necessary in the blood to carry oxygen from the lungs to the cells of the body.

He used to be our India rubber man till he took to milk

Mineral salts containing calcium are needed to make bones and teeth strong. An unborn baby uses some of the calcium from the mother's body. A pregnant woman may take calcium tablets to ensure that she has sufficient calcium salts for herself and the growing baby. If a pregnant woman does not have enough calcium in her diet, then her teeth and bones may deteriorate during her pregnancy.

You have probably experienced cramps in your muscles. This can result when the body loses sodium chloride (common salt) while perspiring heavily.

I forgot to take my salt tablets!

Thus mineral salts are required in small amounts by the body so that it can function properly. The mineral salts, like most other food molecules, are soluble in water and are contained in many foods.

✎ Make a note on the importance of mineral salts in the diet.

WATER

At the beginning of this book, it was noted that in some foods there is a large amount of water. We also drink a large amount of water.

The blood is mostly water. Dissolved in the blood are food molecules, mineral salts and vitamins. The fluid part of the blood acts like a transport system, carrying these materials to different parts of the body.

Outside the blood vessels molecules move from cell to cell dissolved in water. Thus water provides an important means of transportation between individual cells and throughout the body as a whole.

Water is important for giving cells the shape and form that they have. If the cells in the body did not have enough water, they would shrivel and die.

Many important chemical reactions in the body are dependent on the presence of water.

...of course it's the water which gives all those cells such good shape

✍ In your notebook, write the heading: 'The Importance of Water to the Body'. List three reasons why water is important to the body.

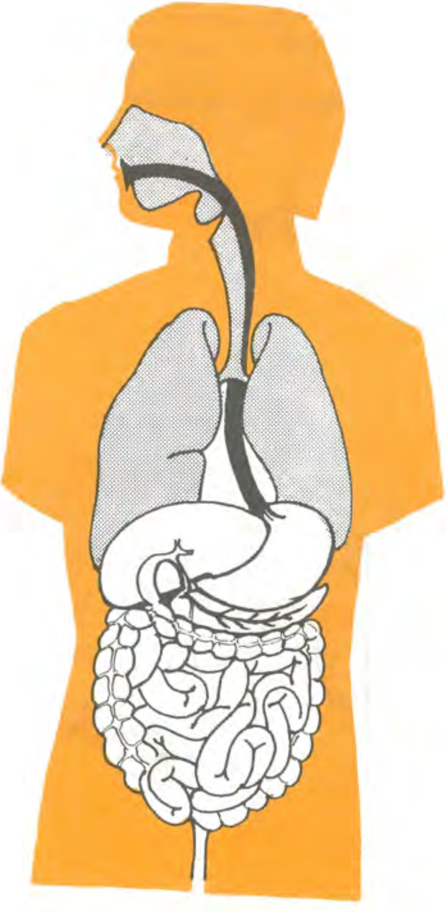
WHAT HAPPENS TO FOOD AFTER YOU EAT IT?

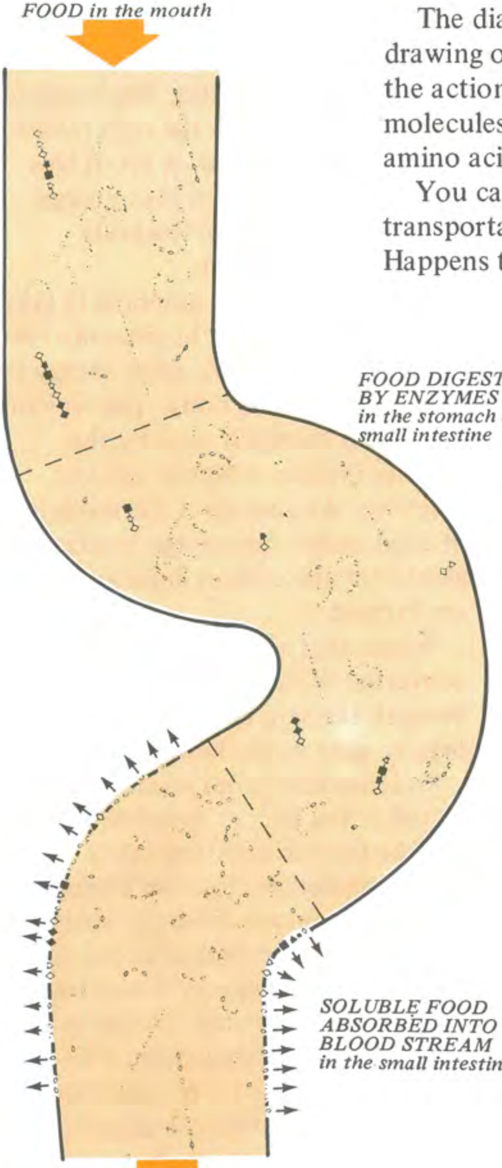
Chewing food breaks it down into smaller pieces. Then the food moves through a long coiled tube called the alimentary canal or gut.

The food we eat is broken down in another way, too. As it passes along the alimentary canal, it mixes with chemicals called enzymes. The enzymes break the large molecules of the food into smaller molecules. This process is called digestion.

The walls of the small intestine are composed of muscle. The food is moved along the small intestine by muscle action. Some of the food is in the form of small molecules dissolved in water—that is, they are **soluble molecules**. The inner lining of the intestinal wall is made of finger-like structures called villi. The soluble molecules are absorbed into the villi, and, hence, into the walls of the intestine and pass into the blood stream. (You can see a photo of villi on page 50.)

The larger insoluble molecules pass on along the large intestine and finally leave the anus as a part of the faeces.




FOOD in the mouth
FOOD DIGESTED BY ENZYMES in the stomach and small intestine
SOLUBLE FOOD ABSORBED INTO BLOOD STREAM in the small intestine
FAECES out through the anus. (UNDIGESTED FOOD AND OTHER MATERIAL)

The diagram on this page is a very simplified drawing of the alimentary canal. Notice how the action of enzymes breaks down the big molecules into small molecules of glucose and amino acids.

You can find out more about digestion and transportation of food in Option 4 (What Happens to the Food We Eat?).

After passing into the intestinal wall, digested food is transported by the blood to the liver (see diagram, page 51). Some of the food is stored in the liver. The rest is transported by the blood to other body cells. It is in the cells of the body that energy is released.

In your notebook state what enzymes do to the big food molecules. Use the word 'digestion'.

THE RELEASE OF ENERGY IN THE CELLS

There are two chemical substances required for the release of energy in the cells. These chemical substances are:

☐ oxygen molecules

☐ molecules from food.

As oxygen in the air is taken into our lungs, it passes into the blood vessels in the wall of the lungs. Through these vessels, oxygen is taken to all the cells of the body.

The oxygen is used in the cells to oxidize food molecules. The oxidation of food molecules in the cells releases energy from the food. A lot of this energy is changed into heat energy which is used to keep the body temperature constant.

When amino acids combine to form protein, energy must be present (see page 15). Muscles also need energy so they can move the body. The way in which this energy is used by the muscles involves a whole series of reactions. As a result of the oxidation of food molecules, energy is released and water and carbon dioxide are formed.

Foods that are not oxidized may be converted to fat and deposited beneath the skin or around internal organs, such as the kidneys.

Glucose that is not oxidized may be stored in the liver or muscles. Energy may be used to combine many glucose molecules to form **glycogen**. Glycogen is a carbohydrate 'store' and can easily be broken down again to glucose when energy is required.

It is difficult to tell if water is produced during oxidation. This is because there is a lot of water already in the body and because drinks and foods taken into the body contain water. However, you can test to see if carbon dioxide is produced by the body. But first you need to know a test for carbon dioxide.

ACTIVITY 6: A TEST FOR CARBON DIOXIDE

Here is a way to make some carbon dioxide, and test it.

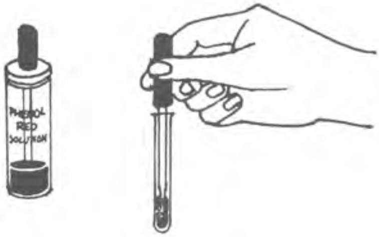
You will need:
- dilute hydrochloric acid
- sodium carbonate
- phenol red solution
- 2 small test-tubes
- 2 droppers
- 1 small spatula (or the broad end of a toothpick).

Place a small amount of sodium carbonate in a test-tube. Add two drops of the dilute acid.

Use a clean, dry dropper to collect the carbon dioxide.

Be careful not to get any of the acid on the dropper.

Bubble the contents of the dropper through 5 drops of phenol red solution.



What happens to the phenol red solution?

In your notebook, write a summary of the test for carbon dioxide.

ACTIVITY 7: BREATHING OUT

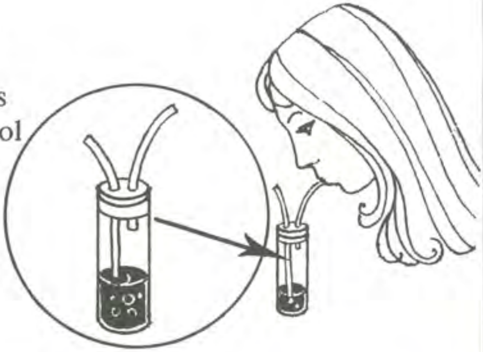
You can see if there is any carbon dioxide in the air you breathe out by blowing through some phenol red solution. If the phenol red turns yellow, then carbon dioxide is in your breath. You will also need to check whether there is sufficient carbon dioxide in the air to change the colour of the phenol red solution.

You will need:

- 1 beaker, 50 ml
- 1 piece of glass tubing (or a drinking straw)
- phenol red solution
- 1 vial with double-holed cap and tubing as shown.

Take about half a beaker of phenol red solution. Use the glass tubing to bubble your breath slowly through this solution.

There is a small amount of carbon dioxide in the air. You need to check if this can change the colour of the phenol red solution. Use the apparatus shown to bubble air through the phenol red solution by sucking air out of the vial.



Describe what happens to the phenol red solution in each case. What causes the phenol red solution to change colour?

SUMMARY

Before you start on the options it is mportant that you find out whether r not you understand Food and nergy.

Work through the following uestions with a partner. You should e able to find the answers to most of he questions in what you have written n your notebook.

1 What are the five main kinds of food substances?

2 Which one food substance is important mainly because it provides substances for growth?

3 Which three substances provide energy?

4 Which two substances help to prevent certain body ailments or diseases?

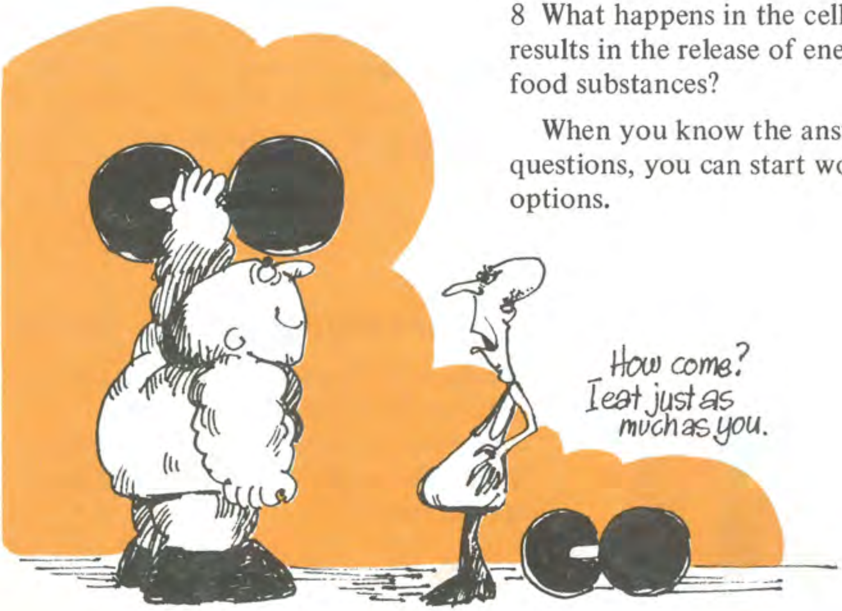
5 What are the simple ways of illustrating glucose, cane sugar, starch, cellulose, fats, amino acids and proteins?

6 From which food substance is urea formed?

7 How does digested food material get from the alimentary canal to the body cells?

8 What happens in the cells that results in the release of energy from food substances?

When you know the answers to the questions, you can start work on the options.


How come? I eat just as much as you.

ABOUT THE OPTIONS

Here are summaries to help you decide which options to choose.

OPTION 1:
TESTING FOODS .... Page 28

What is there in food that is good for you? This is an opportunity to make use of the tests for the various substances in foods.

OPTION 2:
MEASURING THE ENERGY OF FOOD .... Page 34

Television advertisements tell you to eat plenty of X, the energy food, for your breakfast. How can you show that food is a source of energy? How can this energy be measured? How much energy do you need for your day-to-day activities?

OPTION 3:
ENZYMES INSIDE YOU .... Page 40

Here is an opportunity to put your enzymes into action! You thought enzymes were things in soap powders? Well, you can put them to work in this option, too.

OPTION 4:
WHAT HAPPENS TO THE FOOD WE EAT? .... Page 47

In this option you can set up an experimental model of your intestine. (It's not quite as bad as it sounds!) You can also do some food tests and make some important deductions about how food is absorbed into the blood.

OPTION 5:
REGULATING THE DIET ... Page 52

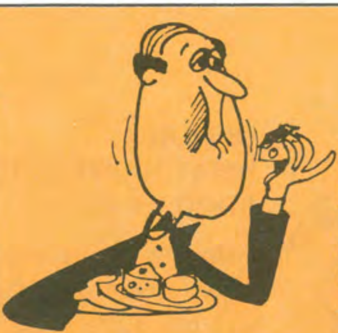
'Eat what you like and like what you eat'—but is the food you eat doing you any good? How can you decide whether your diet is well regulated? This is mainly a reading option.

OPTION 6:
THE SHAPE YOU ARE ..... Page 55

What does it mean to be fat. How do you decide whether you are too fat? What's wrong with being fat anyway? In this option you will also have an opportunity to invent a measuring instrument.

OPTION

1



What is there in food that is good for you? This is an opportunity to make use of the tests for the various substances in foods.

Testing Foods

A quality-control check applied to processed food.

It is important that people who plan menus and diets should know what substances are contained in foods. It is not easy to find out how much of a particular substance is present in food, but we can find out if the substances can be detected.

In the first section of this book you did tests for:

- ☐ starch
- ☐ glucose
- ☐ fat
- ☐ protein
- ☐ vitamin C.

Now you can try these tests using some foods. It would be interesting to use a range of foods for the tests, especially foods that you normally eat. These could include samples of vegetables (fresh and canned), fruits (whole and as juices), meats, fish, nuts, Vegemite, cheese, eggs, beverages such as tea or coffee.

In your notebook draw up a table similar to the one below. This will make it easier to refer to your results.

FOOD TESTED	STARCH	GLUCOSE	FAT	PROTEIN	VITAMIN C

In the first column list four or five foods you intend to test.

In the other columns, write a plus sign if the food gives a positive test, and a minus sign if the food does not give a positive test. You will probably not do all the tests with all the foods, so you may have some blank spaces.

ACTIVITY 1: TESTING FOR STARCH

Preparing Foods for Testing

To prepare the foods for testing you will need a pestle and mortar to make **food solutions.**

To do this take a small piece of the food (about the size of a pea) and crush it up with the pestle in 1 teaspoonful of water. Rinse the mortar and pestle after grinding each food.

You can now test some of these food solutions for starch. If you have forgotten the test for starch, you should review it on page 11.

Complete your table as you do each test.

ACTIVITY 2: TESTING FOR GLUCOSE

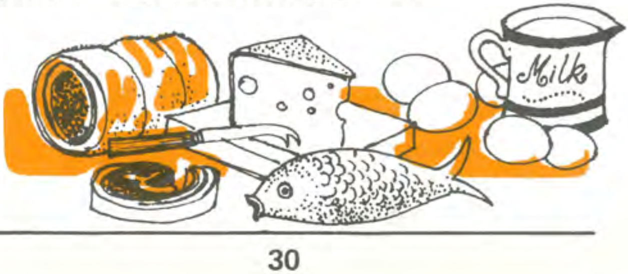
Do this test on some of the food solutions.
(The test for glucose is on page 10.)

ACTIVITY 3: TESTING FOR FATS

Do this test on small pieces of solid food (not food solution).
(The test for fats is on page 13.)

ACTIVITY 4: TESTING FOR PROTEIN

Do this test on some of the food solutions.
(The test for protein is on page 16.)



ACTIVITY 5: TESTING FOR VITAMIN C

(The test for vitamin C is on page 17.)

Instead of just finding out if vitamin C is present, you could also compare the amount of vitamin C present in different foods. You can do this by finding out the number of drops of food solution that are required to produce a positive test.

You will need:
- 1 rack of test-tubes, small
- 2 droppers
- DIP solution
- a variety of foods, in solution form.

Place 20 drops of the DIP solution in a test-tube. Add the food solution drop by drop. Shake the test-tube gently after each drop.

Record the number of drops of the food solution required to produce a positive result.

Compare the results of your tests with those of other students. If your results differ, it would be worthwhile repeating the tests so that you can be sure of them.

When you have finished the tests you could discuss with other students some of the questions that follow.

FOOD PREFERENCES

Each of us likes some foods better than others. Some like meat, others prefer fish. Some like potatoes, others prefer rice.

✍ Make a list of between five and ten foods that you like best.

✍ Of the favourite foods you listed, how many would supply protein?

(On page 53 you can check the recommended amount of protein in the diet. The tables on pages 67 to 75 will help you to check the amount of protein in the foods that you prefer to eat.)

✍ How many of the foods that you prefer to eat contain vitamins and/or mineral salts? If you only ate your favourite foods, do you think that you would have sufficient vitamins and mineral salts in your diet? (The tables on pages 67 to 75 will also help you here.)

YUK! Black fish eggs and fermented grape juice

ADDITIONAL ACTIVITIES

1 You could investigate the effect of cooking on the vitamin C content of food. Does cooking destroy or change the vitamin C content?

2 You could try to find out if there is any vitamin C in canned food.

3 When foods are cooked in water the mineral salts from the food dissolve in the water and are often thrown away with the water. You could read about the best ways of cooking so that you do not lose too many mineral salts from food. One reference you could use is:

Fox, B.A. and Cameron, A.G., *A Chemical Approach to Food and Nutrition.* London, University of London Press, 1961.

4 You could read about a way to prepare food to avoid including too much fat in the diet.

OPTION 2

Television advertisements tell you to eat plenty of X, the energy food, for your breakfast. How can you show that food is a source of energy? How can this energy be measured? How much energy do you need for your day-to-day activities?

Measuring the Energy of Food

Even with elaborate equipment, it is difficult to measure how much energy your body gets from the food you eat.

Usually scientists studying food energy take a short-cut. They measure the heat energy produced by burning food. Then they assume that food releases as much energy inside our bodies as it does when it burns.

ACTIVITY: BURNING FOOD

The energy released from burning food can be measured by using it to heat some water. You could use one of these foods—peanuts, dripping, cooking oil, powdered milk, icing sugar, marshmallows.

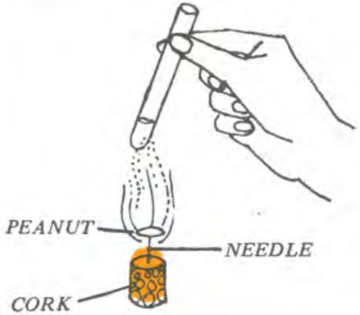
As well as the food you are going to burn, you will need:

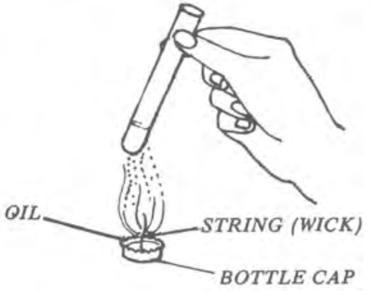
- 1 thermometer
- 1 measuring cylinder
- 1 large test-tube.
- heating equipment (see page 35).

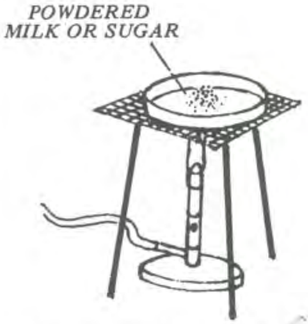
Pour 10 millilitres of water into the test-tube, and measure its temperature.

Write in your notebook:
Temperature of water
before heating = ... °C.

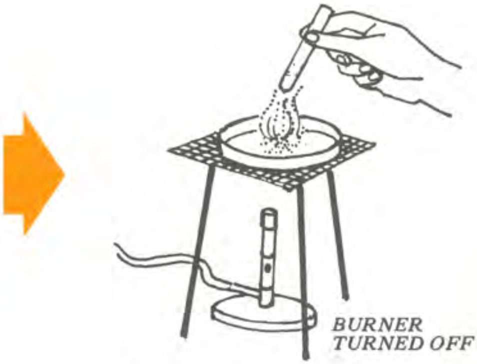
Depending on which food you burn, the water can be heated as shown. When the food has finished burning, measure the water temperature again.







Heat the lid until the powder catches fire.

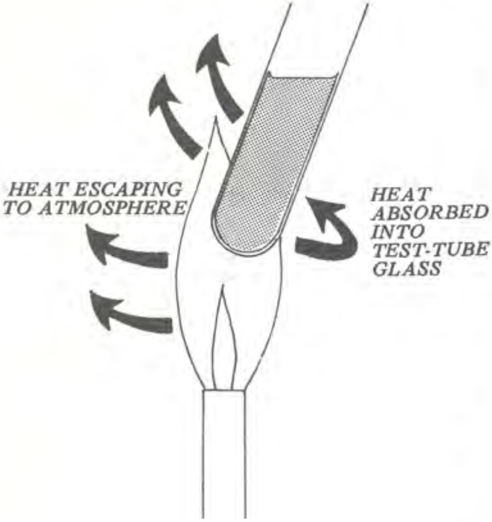


Then turn out the burner, and heat the test-tube over the burning food.

Write in your notebook:

Temperature after heating = ... °C

Rise in temperature = ... degrees.


HEAT ESCAPING TO ATMOSPHERE
HEAT ABSORBED INTO TEST-TUBE GLASS

.Heat and other forms of energy are measured in **joules**. One joule is a very small amount of energy–to heat 10 millilitres of water by only 1 Celsius degree takes 42 joules.

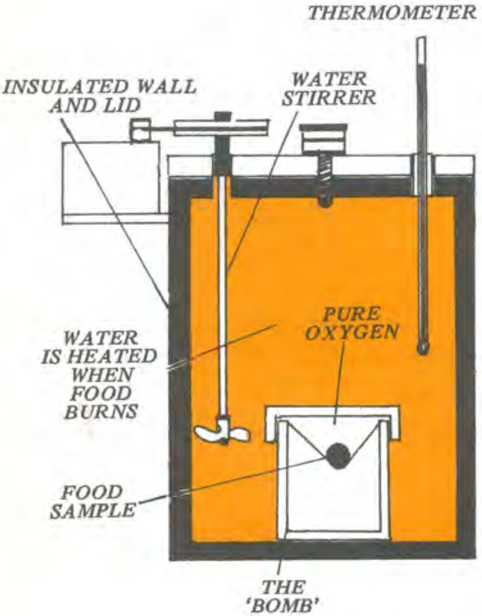
Only some of the heat released by the food you burned heated the water. Some of it heated the glass of the test-tube, and a lot 'escaped' to the air.

You can measure the amount of heat the water absorbed by multiplying the temperature rise by 42.

For example, if the water became 10 degrees hotter, the heat it absorbed was:

$$\begin{array}{r} 10 \\ \times\ 42 \\ \hline 420 \end{array}\ \text{joules}$$

✍ Calculate how much heat the water in your test-tube absorbed from the burning food.



Scientists studying the energy released from food, use an instrument called a **bomb calorimeter.** Very little heat can escape from this instrument, so almost all the energy released by the burning food can be measured.

The 'bomb' is a strong metal container. After the mass of a sample of food is carefully measured, it is put into the container which is then filled with oxygen.

The bomb is placed in a container of water and an electric current is passed through the food sample. In this way the food is heated enough for it to start burning. It burns quickly in the oxygen, and the heat passes into the water. The temperature rise of the water is measured with a thermometer.

Measured with a bomb calorimeter, the energy values of food are about:

carbohydrates	1700 joules per gram
proteins	1700 joules per gram
fats	3800 joules per gram

Actually the energy you obtain from food is less than the calculated energy from the bomb calorimeter measurements. This is because some of the food you eat is not digested and is eliminated from your body. If food is eliminated from the body, energy cannot be released from it.

The amount of energy a person turns into work and heat and uses for growth is calculated by measuring the amount of oxygen he uses.

The table at right shows how many kilojoules a 60 kilogram person uses in an hour. The unit kilojoule (kJ) means 1000 joules (J). It is used instead of joules to avoid big numbers. For example, 700 kilojoules (in the first line of the table) equals 700 x 1000, or 700 000 joules.

ACTIVITY	ENERGY USED* (kilojoules per hour)
CYCLING	700–1500
DANCING	900–1200
GYMNASTICS	2500
HOUSEWORK	500–1000
LYING STILL	300
OFFICE WORK	500
RUNNING	2500–33 000
SITTING STILL	350
SLEEPING	250
STANDING	400
SWIMMING	1500–11 000
TABLE TENNIS	1200
WALKING	600–2400

If over a period of time your energy intake just balances your energy output, your body is using up energy at the rate it is being taken in.

What will happen to your weight if you eat more food and use up the energy as before?

What will happen to your weight if you exercise less but do not change the amount of food you eat?

If you eat less food, or if you take more exercise, then you will use up some of the fat or glycogen stored in your body and so your weight will decrease.

If you are still growing, you would expect your weight to increase, and this is not a bad thing. Your weight would also increase if you are building up muscle by exercising. You can read more about controlling body weight in Option 6 (The Shape You Are).

Remember that some of the food you eat is not digested and is eliminated from the body. This means that the energy taken in can only be estimated, because some energy is passed out of the body in the faeces.

However, if one assumes that all energy in the food is kept in the body, an estimate of your energy balance can be worked out.

You can complete a table something like the one below.

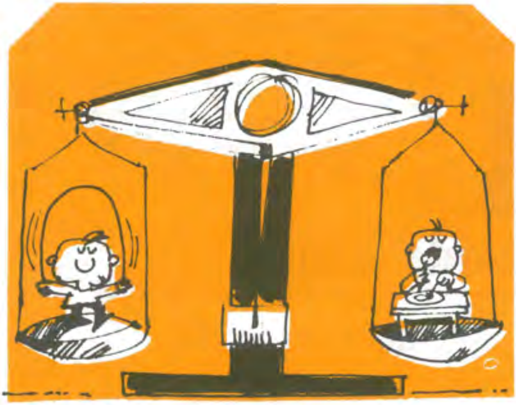
ENERGY IN

List everything that you ate or drank yesterday.	*In this column estimate the size of the portion eaten—e.g. 1 cup, 1 slice, etc.*	*Use the tables on pages 67 to 75 to calculate the energy in the things you ate*.*	*Add up the total energy taken in for the day.*
FOOD EATEN	**QUANTITY**	**ENERGY VALUE**	**TOTAL ENERGY VALUE (kJ)**

ENERGY GAINED..................kJ

*** 2 slices of bread and butter = 889 kJ**
2 pieces of cheese 2 X 336 = 672 kJ

If you ate or drank something that is not listed, use the energy value of a similar item.



Is your total energy gained greater than the total energy lost? Work this out in your notebook.

Energy gained – Energy lost =..... kJ
(Energy In) (Energy Out)

Compare your table and final energy balance with those of other students.

ENERGY OUT

List the things that you did for the whole day yesterday (24 hours)–e.g sleeping, sitting, standing.	*Write the approximate number of hours you spent on each sort of activity.*	*Calculate the total energy used for each activity, using the list on page 37*.*	*Work out the total energy used for the whole day.*
ACTIVITY	TIME SPENT	ENERGY VALUE	ENERGY EXPENDED (kJ)

ENERGY LOST..................kJ

---

* Try to use numbers which make your calculations easy. If it took you ten minutes to cycle to school (1/6 of an hour) then use a value in the range 700 to 1 500, such as 1 200, which is easy to divide by six.

OPTION 3

Here is an opportunity to put your enzymes into action! You thought enzymes were things in soap powders? Well, you can put them to work in this option, too.

Enzymes Inside You

Enzymes are found in all living things. You have already read that enzymes are used by the body during the digestion of foods (see page 20). However, enzymes are used by the body not only for digestion, but for many other chemical processes as well.

Another process for which enzymes are necessary is the release of energy. Without enzymes we could not live. Other animals and plants also require enzymes in order to remain alive.

Enzymes are proteins. These proteins need to be present in very small quantities only. A small amount of the enzyme will speed up the rate of a chemical reaction in the body. Each chemical reaction is different and requires a particular enzyme to speed it up.

This option has a number of investigations that you can do to find out more about enzymes.

CHANGING THE TASTE

If you chew a piece of dry bread for a minute, you may notice a change of taste. Some people report a slightly sweet taste, as if some sugar had been produced. You can investigate the effect of saliva on dry bread.

Stand back! I'm just the right shape to get into and break up this molecule.
ENZYME 1
ENZYME 2

ACTIVITY 1:
AN ENZYME IN YOUR MOUTH

You can use the tests for glucose and starch to see what happens to food in your mouth. (If you have forgotten how to do these tests, refer to pages 10 and 11.)

To create conditions similar to those in your mouth, you will need a water bath. This will keep the chemicals at about body temperature.

You will need:

- 2 beakers, 50 ml
- 1 stirring rod
- 1 thermometer
- 1 rack of small test-tubes
- iodine solution
- Testape, 2 cm long
- 1 small piece of bread, about the size of a pea
- 1 burner, tripod and gauze mat
- 1 wooden peg
- 2 droppers.

You can prepare a water bath by half filling one beaker with water and heating the water to between 35 °C and 40 °C. (Body temperature is about 37 °C.) Use the glass rod to stir the water and the thermometer to check the temperature of the water.

Alternatively, if your science room has hot running water, mix hot and cold water until you get the temperature that you want.

To record your results for the following tests you will need to draw in your notebook a table like that shown below.

	BEFORE BEING PUT IN THE WATER BATH		AFTER BEING IN THE WATER BATH FOR FIVE MINUTES	
	STARCH TEST	GLUCOSE TEST	STARCH TEST	GLUCOSE TEST
STARCH + WATER				
SALIVA + STARCH + WATER				
SALIVA + WATER				

Dribble saliva into the other beaker. (It may help to chew on a clean rubber band.) Keep doing this until you have about 5 millilitres or more.

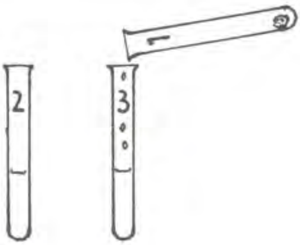
Put the piece of bread into a test-tube and about three-quarter fill the test-tube with water.

Shake the test-tube to release particles of starch into the water.

Do a test for starch and a test for glucose using drops from the starch solution you have just made.

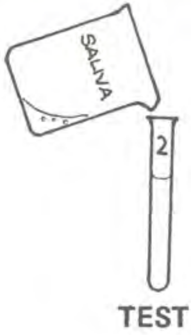
Record the results in your notebook using a table like that shown on page 41.

Now divide the starch and water between two other test-tubes. (When you are pouring, keep the piece of.bread in its original test-tube.)



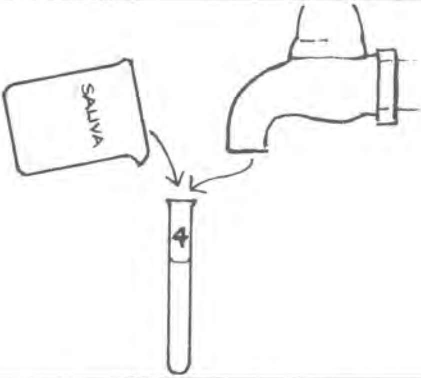
To one of these two test-tubes
containing starch and water,
add half the quantity of saliva.

Test for starch and glucose immediately.



Then put both test-tubes into the water bath.

To another test-tube, add the other half quantity of saliva. Add water until the depth of liquid is the same in all the test-tubes. Do a test for starch and a test for glucose using drops of this saliva solution.



Then place the test-tube in the water bath with the other two test-tubes.

After the three test-tubes have been in the water bath for five minutes, do both the starch test and the glucose test with a few drops from each test-tube separately.

You may also want to see what happens if the test-tubes are kept in the water bath for a further five minutes.

Use your table to summarize your results. Then you can note whether any changes have occurred.

See if you can find out the name of the enzyme contained in saliva. One of the following may be a useful reference.

Mackean, D.G. *Introduction to Biology.* London, John Murray, 1962.
Best, C.H. and Taylor, N.B. *The Living Body.* (4th ed.) London, Chapman and Hall, 1959.

ACTIVITY 2: TESTING ENZYME DETERGENTS

Some detergents contain enzymes that react with proteins in materials such as blood or egg. You could compare an enzyme detergent with a detergent that doesn't have enzymes.

A piece of blood-stained or egg-stained cloth could be put into a solution of each detergent, and you could compare the results.

Make sure that it is a fair test by treating the two detergents in exactly the same way. You will need to use:

□ the same strength solutions.

□ the same amount of solution for each detergent.

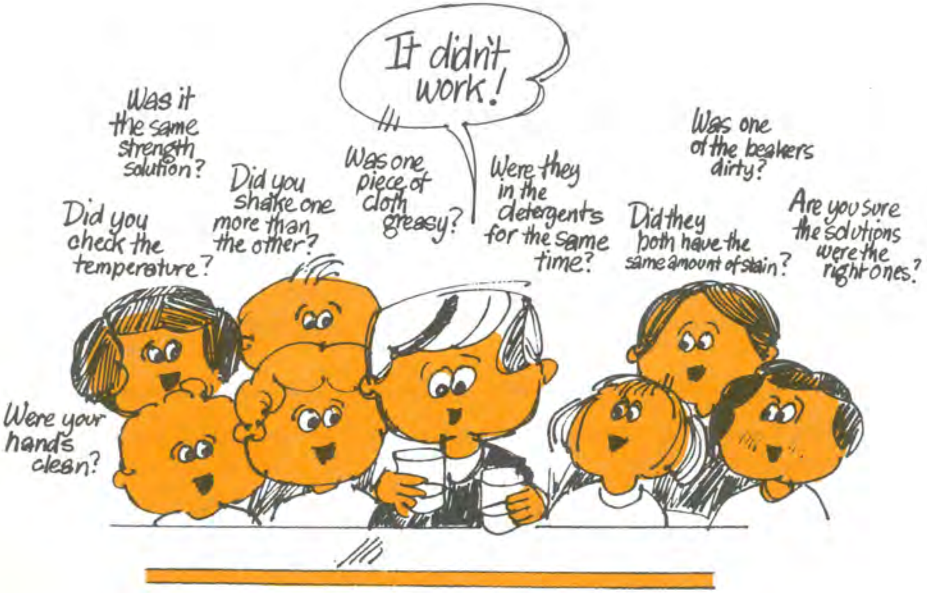
□ the same temperature.

□ the same type and amount of stain.

□ pieces of cloth of the same type and size.

□ the same length of time.

Write a report describing what you did, and what you found out. Which detergent was more effective?


Was it the same strength solution?
Did you check the temperature?
Did you shake one more than the other?
Was one piece of cloth greasy?
It didn't work!
Were they in the detergents for the same time?
Did they both have the same amount of stain?
Was one of the beakers dirty?
Are you sure the solutions were the right ones?
Were your hands clean?

ACTIVITY 3: ENZYMES AND TEMPERATURE

Enzymes work more quickly at some temperatures than at others. You can test this by putting some enzyme detergent on a stain at different temperatures.

For example:

☐ About 0 °C (water which has been in a refrigerator, or water which has been cooled with ice).

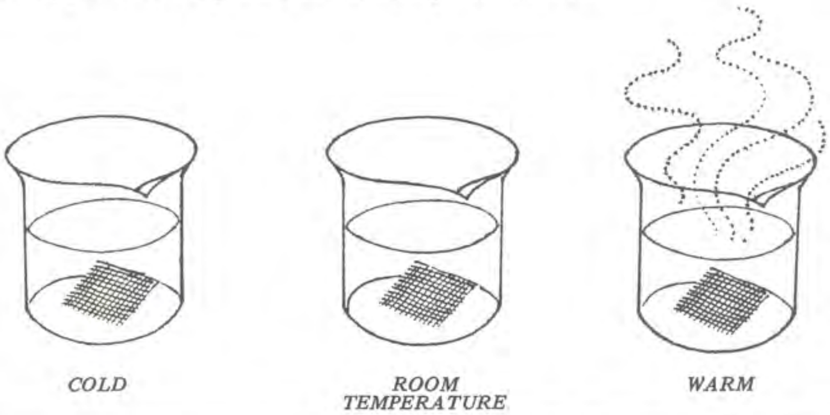
☐ About 35 °C to 40 °C (mix hot and cold tap water to obtain the correct temperature).

☐ About 100 °C (boiling water).

You will need:

- 3 beakers, 250 ml (or other containers)
- 3 pieces of cloth stained with egg or blood
- enzyme detergent, 1% solution
- some way of heating 1 beaker–e.g. burner
- some way of cooling 1 beaker–e.g. refrigerator or ice
- 1 thermometer.

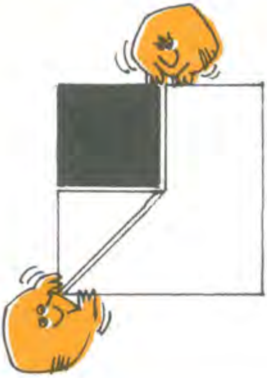
First, prepare the three beakers. Use the same detergent solution for each. Put a piece of stained cloth into each beaker at the same time. Watch what happens over a period of time, say 20 minutes.

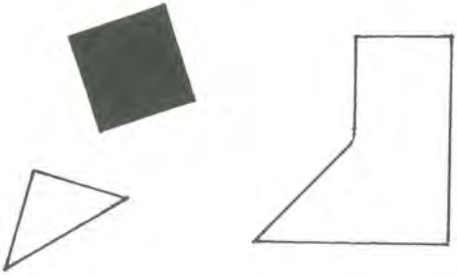


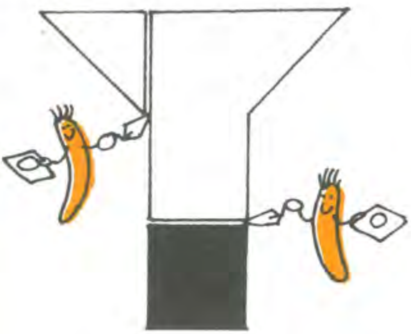
At which temperature does the enzyme work best?

Write a report of your findings. (A table may be a good way to summarize your results.) Then say what you have found out about the enzyme in the detergent you used.

SUMMARY







Enzymes are found in all living cells. You have seen that they cause the breakdown of a carbohydrate (starch) and a protein (blood or egg). This is the process of **digestion**.

The body also uses enzymes to build up large molecules from smaller ones. For example, glycogen molecules are stored in the liver. These are formed when several glucose molecules join together.

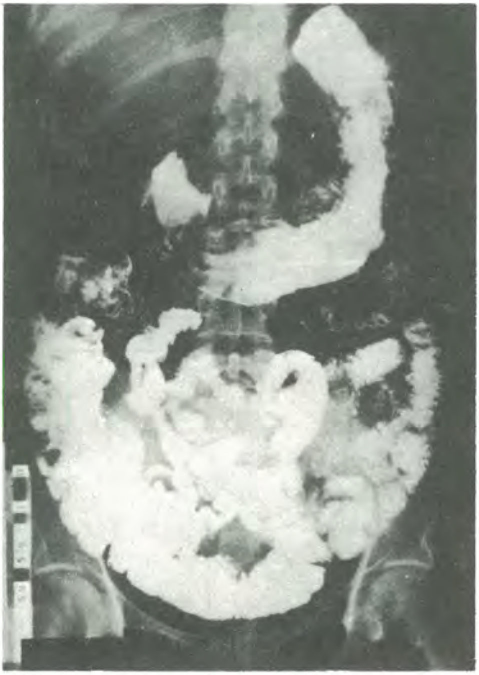
When muscles move energy is used. It is replaced quickly from glucose in the blood. When the amount of glucose decreases it is replaced by the breakdown of glycogen molecules in the liver. Glycogen breaks down to form glucose.

As mentioned above, some enzymes help build up larger molecules from smaller ones. However, enzymes do more than that. When energy is released inside our bodies enzymes are required. Different enzymes are required for different parts of the energy releasing process; each part of it has to take place in turn. The rate of the reaction depends upon the activity of the body. A greater demand for energy will increase the rate of the reaction, and thus increase the rate of energy production.

OPTION 4

In this option you can set up a model of your intestine. (It's not quite as bad as it sounds!) You can also do some food tests and make some important deductions about how food is absorbed into the blood.

What Happens to the Food We Eat?



X-ray photo of the intestine of a person who has swallowed a special chemical.

Some of the food that we eat passes out of the body as faeces. The food that does not pass out of the body as faeces passes through the wall of the food canal–the alimentary canal.

One way of looking at what happens to the food remaining in the alimentary canal is to use X-ray photos. An example of an X-ray photo is shown at left.

Another way of looking at the alimentary canal is to use **dialysis tubing**, which works in a similar way to the gut wall.

Before seeing what happens to food molecules inside dialysis tubing, make sure you know the tests for glucose and starch. You can review these tests on pages 10 and 11.

ACTIVITY:
A MODEL FOR ABSORPTION

You will need:

- 2 beakers, 250 ml
- 2 pieces of dialysis tubing
- 1 reel of cotton
- iodine solution
- Testape, 2 cm long
- 1 small funnel
- concentrated solutions of glucose and of starch
- 1 dropper
- 1 white tile
- 2 toothpicks.

1 Rinse one of the beakers and pour about 50 millilitres of water into it.

2 Wet the outside of the dialysis tubing and tie a knot in one end of it. (Be careful– it might tear.)

3 Pour the glucose solution into the dialysis tubing. Tie the open end with the cotton.

4 Rinse the outside of the tubing under the tap (in case you spilled some solution on it). Lower the tubing into the water in the beaker. Leave it for for at least ten minutes.

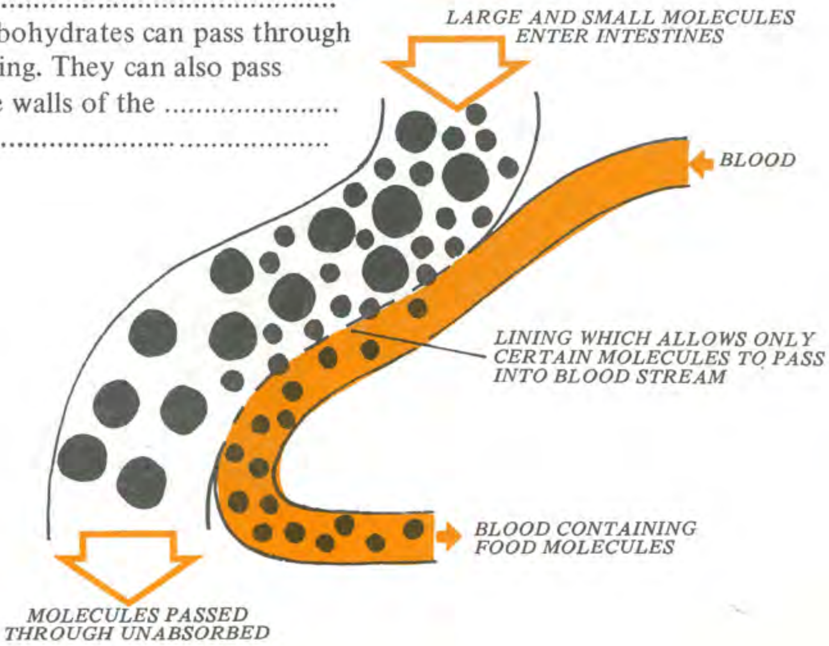
Repeat steps 1 to 4, using the concentrated solution of starch and the second beaker.

Wait ten minutes. Then test the water surrounding the dialysis tubing in each beaker for glucose and starch. Do this by drawing off some water with a dropper.

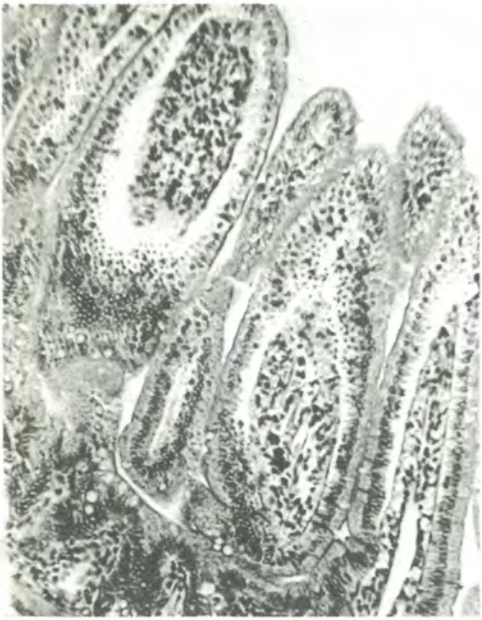
Copy these sentences into your notebook and complete them:

The carbohydrate that passed through the dialysis tubing was
......................; but ....
did not pass through the membrane because ....
....

Soluble carbohydrates can pass through dialysis tubing. They can also pass through the walls of the ....
....


LARGE AND SMALL MOLECULES ENTER INTESTINES
BLOOD
LINING WHICH ALLOWS ONLY CERTAIN MOLECULES TO PASS INTO BLOOD STREAM
BLOOD CONTAINING FOOD MOLECULES
MOLECULES PASSED THROUGH UNABSORBED

STRUCTURE OF THE ALIMENTARY CANAL



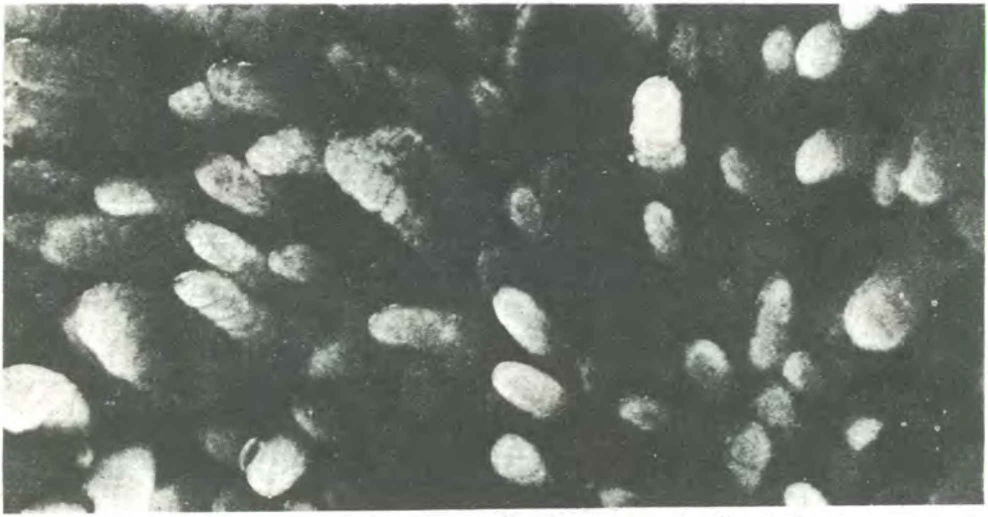
Villi from a rat intestine. The villi have been cut to show the internal structure. X*100*

The alimentary canal is not as simple as the dialysis tubing.

The photos on this page show finger-like projections of the gut wall called **villi** (singular: **villus**).

The area of the folded internal wall of the alimentary canal is ten times the area it would be if it were smooth like the dialysis tubing.

✍ What makes the area so much bigger? In what way would the bigger area affect the absorption of digested food substances?



Human villi photographed from the cavity of the intestine. Each villus is about 1 millimetre long. ***(Photo by courtesy Nuffield Foundation.)*** X*10*

WHERE DOES THE ABSORBED FOOD GO?

Dialysis tubing and the gut wall act something like sieves–usually only molecules below a certain size are able to pass through.

In the last activity you investigated two carbohydrates. Some other foods also need to be broken down before they will pass through the gut wall. Proteins are broken down to amino acids.

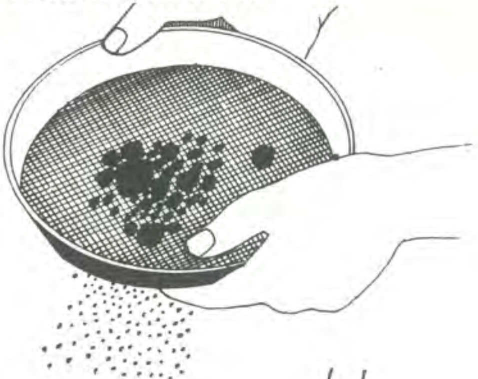
Glucose and amino acids are absorbed into the small blood vessels of the villi.

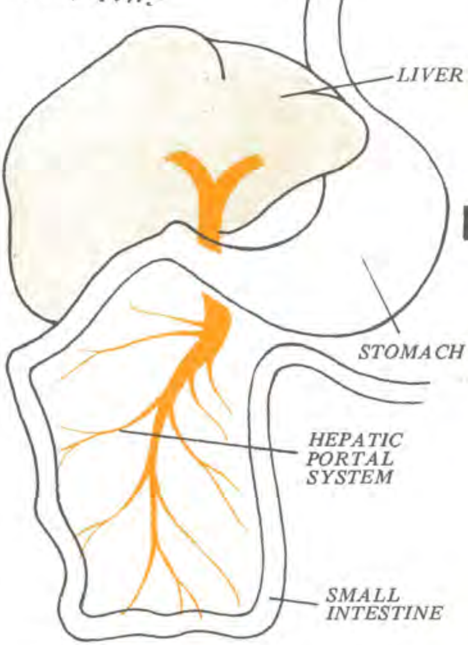
How do the food molecules get from the gut to other parts of the body?

Examine a preserved and injected rat (or other mammal).

Look at the blood vessels between the small intestine and the liver. This system of blood vessels carries food from the gut to the liver. It is called the hepatic portal system.

When the food has been digested in the intestine, it is absorbed through the villi and passes in the blood to the liver. The blood carries the smaller food molecules to all parts of the body where they are used for energy release and growth.





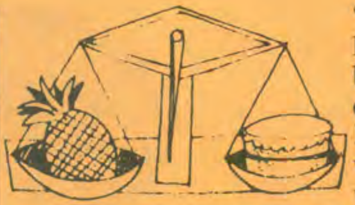
FURTHER ACTIVITIES

1 Obtain a dead mouse, rat or rabbit and **dissect** it to find the various parts of the alimentary canal, the liver and the hepatic portal system.

2 Read more about the digestive system in a reference book. Make some notes on what you read.

OPTION

5



'Eat what you like and like what you eat'– but is the food you eat doing you any good? How can you decide whether your diet is well regulated? This is mainly a reading option.

Regulating the Diet

Is it possible for you to eat as much as you want and be badly nourished? Suppose you were to live on as much chocolate as you could eat, would you be eating enough of the right kind of food? Would you have enough protein, mineral salts and vitamins to remain healthy?

In many countries there are food problems. These problems are of two types. One is **under-nutrition**, when there is just not enough to eat. The other is **malnutrition**, which is caused by a lack of one or more essential **nutrients**.

I can't understand why my pet mouse died. I gave him nothing but the best cheese.

Diets that do not contain fresh fruit and vegetables are likely to be lacking in vitamin C. Long ago sailors often suffered from scurvy because they did not have fresh fruit on long voyages. (See photo, page 17.)

When food is cooked in iron pans, iron is dissolved into the food. It was found that some people began to suffer from anaemia when aluminium pans became popular.

A carefully regulated diet ensures that people eat enough of the major nutrients and enough of all the necessary vitamins and mineral salts. The deficiency of a nutrient may increase the likelihood of disease. An example is shown opposite.

There are recommended average daily dietary requirements. These requirements differ among people. Our bodies are different and have different needs.

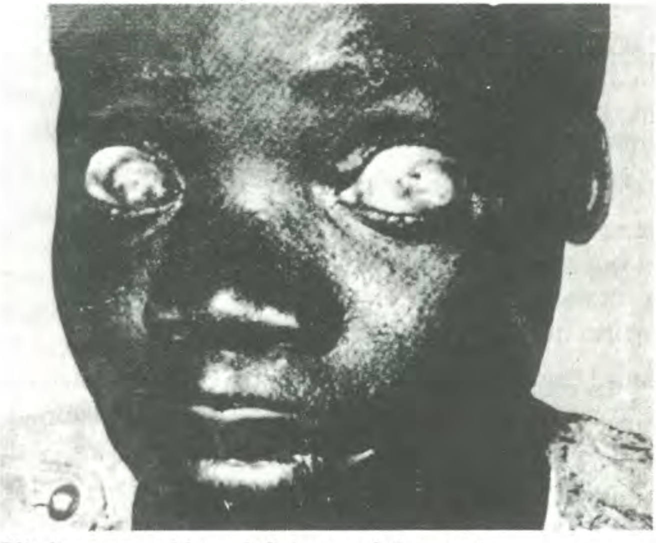
Dietary requirements also depend on such things as how much a person perspires, how active a person is, and the climate.

RECOMMENDED DIETARY ALLOWANCES–AGES 11 TO 15

	ENERGY (kJ)	PROTEIN (g)	CALCIUM (mg)*	IRON (mg)	VIT. A (μg)*	VIT. B_1 (μg)	VIT. B_2 (mg)	VIT. C (mg)
BOYS	12 140	51–87	600–1400	12	725	1.2	1.2	30
GIRLS	10 400	52–75	600–1300	12	725	1.0	1.3	40

* Milligram (mg) is one thousandth of a gram.
Microgram (μg) is one millionth of a gram.

Adapted from: Corden, M. and Thomas, S. *Simplified Food Composition Tables.* Canberra, Commonwealth Department of Health, Nutrition Section, 1971.



Blindness caused by a deficiency of vitamin A.
(From McLaren, D.S. Malnutrition and the Eye. *New York, Academic Press, 1963.)*

ACTIVITY:
HOW WELL IS YOUR DIET REGULATED?

Make a list of everything you eat and drink for a day, and work out what the food supplied to you.

☐ How much energy?
☐ How much protein?
☐ How much calcium and iron (from mineral salts)?
☐ How much of some of the vitamins?

Make a table like the one shown below. Write each of the foods eaten in the left hand column.

If possible you should measure the mass of food you ate at home (or measure similar foods at school). You will need a balance or set of scales. Enter the mass in the second column.

Use the tables on pages 67 to 75 to work out how much of each food type was in the food you ate., Record the figures in your notebook.

Record the total for each column.

Compare what you have found with the recommended dietary allowances on page 53. Don't forget that these are recommended allowances, that individuals differ in their requirements, and that these vary from day to day.

On which of the requirements do you fall short? On which of the required nutrients do you exceed the recommended amount most? Use the tables on page 53 and on pages 67 to 75 and suggest how you could attempt to regulate your diet.

Suggest at least two ways in which you could make up for a lack of vitamin A in a hospital patient's diet. Use the tables on pages 67 to 75.

The protein requirement of the body can be supplied by a whole range of foods. Strict vegetarians do not eat meat or animal products. They can still satisfy the protein requirements of the body from plants and plant products.

FOOD EATEN	MASS OF FOOD (g)	ENERGY (kJ)	PROTEIN (g)	CALCIUM (mg)	IRON (mg)	VIT. A (μg)	VIT. B_1 (μg)	VIT. B_2 (mg)	NIACIN (mg)	VIT. C (mg)

OPTION

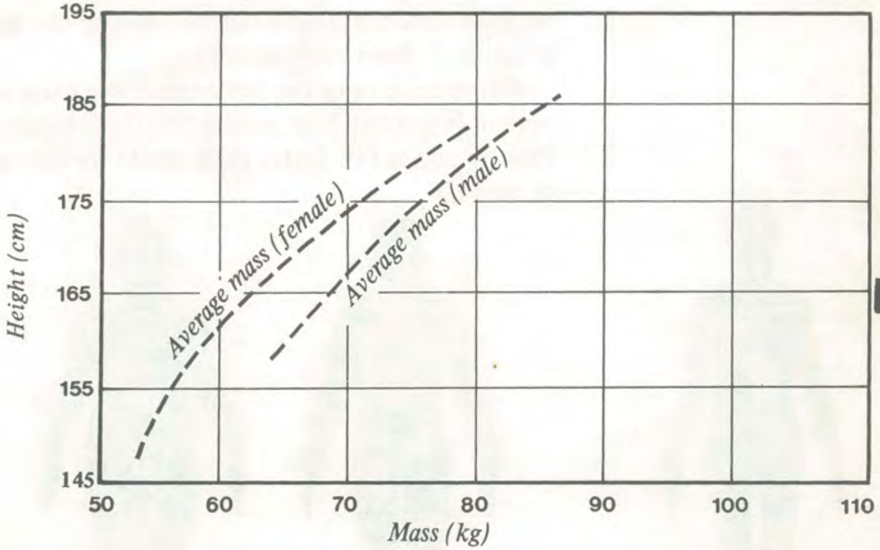
6

What does it mean to be fat? How do you decide whether you are too fat? What's wrong with being fat anyway? In this option you will also have an opportunity to invent a measuring instrument.

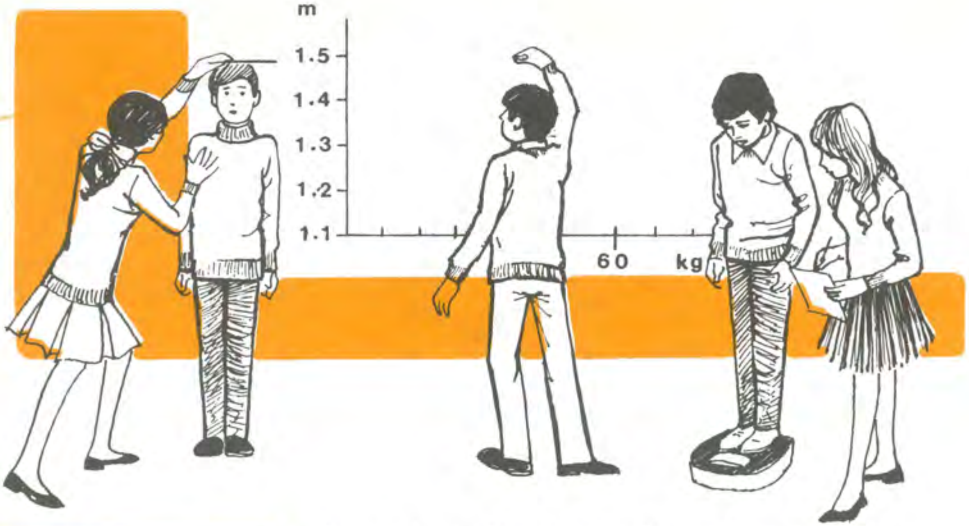
The Shape You Are

For a person of a particular height there is a range of masses that are regarded as normal. You can be heavier or lighter than the average without being too heavy or too light. If a person's mass is considerably more than that shown on the graph below they are said to be overweight.

The graph shows the average masses of adults of particular heights. Keep in mind that this is only a rough guide. (Reliable graphs for children are not available.)



Use the graph to find the average mass of a woman 170 centimetres tall.



ACTIVITY 1: AN INVESTIGATION OF HEIGHTS AND MASSES

You will need a set of scales and a metre ruler. Now measure the mass and height of each student. Put your results on a graph like the one above.

Some people have more muscle than others, some have bigger bones than others, and some have a large food tract (gut) and more fat under the skin. The type of build a person has is determined by the proportions of each of these components.

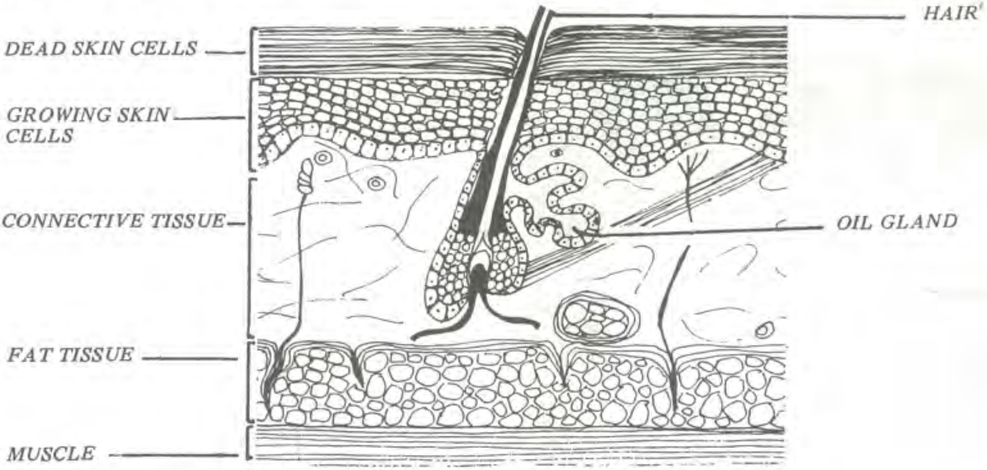
Comparing only the height and the mass of a person is not the best method of determining whether that person is fat. Extra mass could be due to bone or muscle.

Slim build–small bones and light muscle.

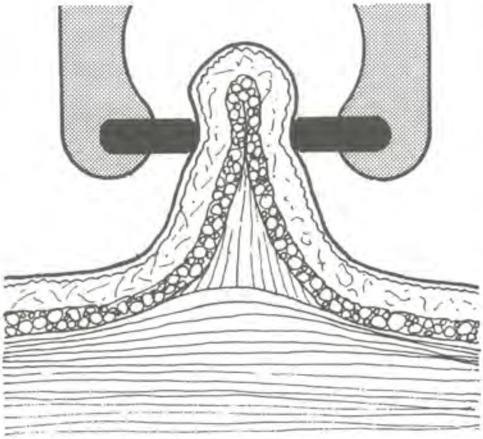
Average build.

Heavy build–large bones and bulky muscle.

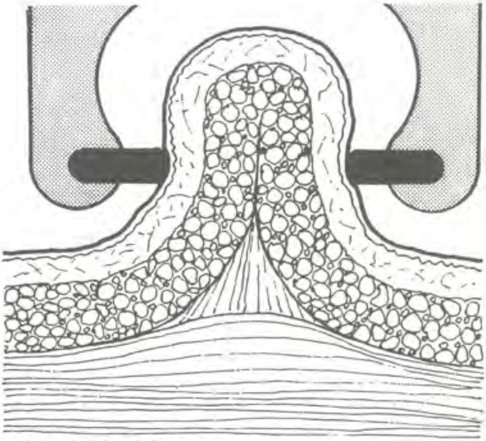
To find out if your body has excess fat, you need to be able to measure how much fat is stored between the skin and the muscle layer.



A plumper person has a greater thickness of fat under the skin than a person of average mass. If the skin is pinched, a double fold of skin and fat is formed.

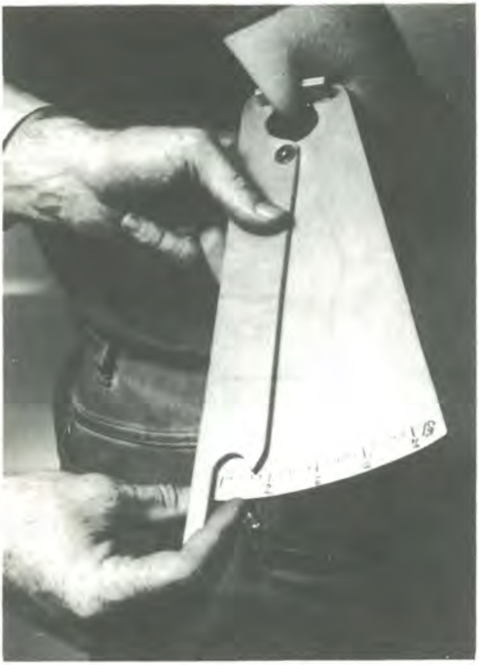


Skin fold of thinner person.



Skin fold of fatter person.

ACTIVITY 2: MAKING A FAT-FOLD MEASURER



One type of fat-fold measurer in use. Other types of measurer can be made.

Your group could design and make an instrument to measure fat-fold thickness.

The photo at left shows one way of making a fat-fold measurer. However, all such measurers:

☐ should not have sharp parts that would cut or bruise the skin.

☐ should have a scale directly on the instrument.

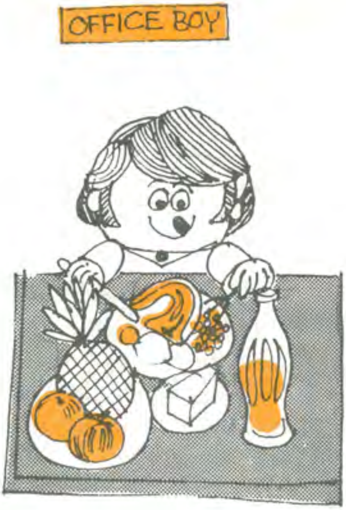
When you use the fat-fold measurer you should try to apply an even pressure. Don't press hard as this causes bruising.

There are several places on the body where the fat-fold could be measured. A convenient place is the back of the upper arm, halfway between the elbow and the shoulder.

✎ Record the fat-fold measurements of a number of people.

You could investigate whether there are any differences in fat-fold thickness between the sexes. You would need to take an equal number of measurements for boys and girls and find the average measurement for each group.

You could also compare the fat-fold measurements of people of different ages. Include children and adults.



PROBLEMS OF BEING OVERWEIGHT

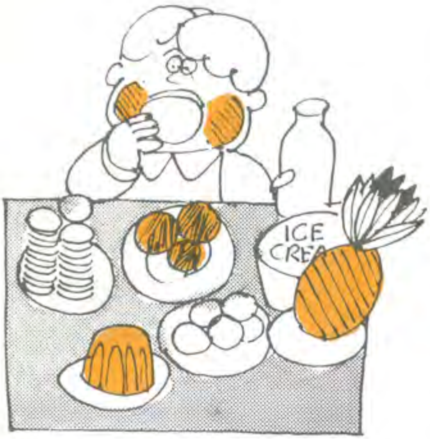
Why should we try to control our mass as we grow up? Studies show that people who are overweight run a greater risk of developing certain illnesses. These include:

☐ high blood pressure
☐ diabetes
☐ cancer
☐ liver disease
☐ gall bladder disease
☐ clots in the blood vessels of the brain.

You would not be surprised then, to find that it is more likely for a person who is overweight to die at a younger than average age. It follows that the more fat a person carries, the greater is the risk of dying earlier than expected.

There's less risk insuring lion tamers.
LIFE INSURANCE

HOW CAN YOU CONTROL YOUR MASS?



There are many reasons why you could be overweight. Some people eat to ease feelings of tension. Others are overweight because of a glandular disorder. But for the majority of people who are overweight the problem is often one of eating between meals, or of eating and drinking the wrong things.

If you eat snacks such as sweets, ice cream, fizzy drinks, potato chips, etc. between meals, the energy you take in will increase.

You can check this for yourself. Look up the energy value of the foods in the tables on pages 67 to 75. How much would this increase your energy intake if you ate 100 grams of each snack mentioned everyday for a week? For a month?

No thanks I'm wanting to keep a good figure

Check the tables on pages 67 to 75 to determine how much you could reduce your daily energy intake by not having two cakes, 100 grams of chocolate, and one milk shake.

It could be that to reduce your mass, it would simply be a matter of not having snacks between main meals. For example, by not eating cake or chocolate each day, you could reduce your mass.

The **pattern** of eating is important. If you are very active during your school years and play a lot of sport, you probably have a very good appetite. You are building up a pattern of eating big meals.

If you stop playing sport when you leave school, what might happen to your mass if you eat the same amount of food?

Now that I've given up football you will have to reduce the size of the meals

Try sitting a little farther from the table — about six feet farther

SUMMARY

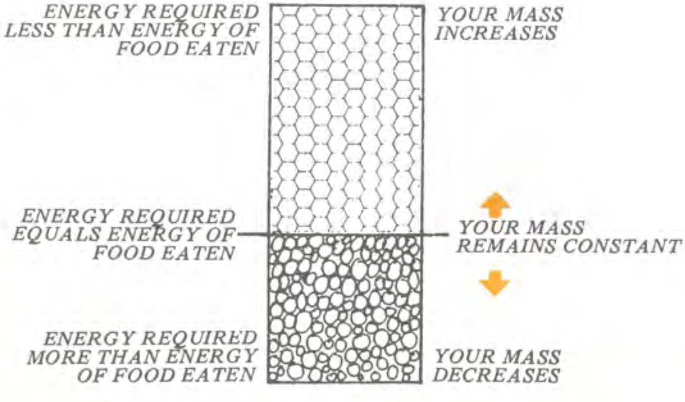
What Makes You Overweight?

In the first part of *Foods* you read that when food is oxidized energy is released. This is also discussed in Option 2 (Measuring the Energy of Food).

The energy released from food is required by the body in order that it may function, including during sleep. Digested food not used for energy release can be stored as fat or as glycogen.

When you increase the amount of exercise that you do, then your energy output increases. If you do not eat extra food then your mass will decrease. This is because stored food is used to supply the extra energy required. Glycogen from the liver would be the first source of this extra energy. Some of the fat beneath the skin would then be used.

Body mass is related to the energy needs of the body and to the pattern of eating. You have also seen that it is advisable to avoid between-meal snacks if you are inclined to be overweight.


ENERGY REQUIRED LESS THAN ENERGY OF FOOD EATEN
YOUR MASS INCREASES
ENERGY REQUIRED EQUALS ENERGY OF FOOD EATEN
YOUR MASS REMAINS CONSTANT
ENERGY REQUIRED MORE THAN ENERGY OF FOOD EATEN
YOUR MASS DECREASES

Anyone who intends to diet strictly should consult a doctor. However, a person who is trying to control his mass–but not 'reducing' severely–should keep these points in mind:

1 It is unwise to reduce the intake of protein-rich foods (meat, eggs, fish, cheese, nuts) or green vegetables. You also need many of these foods for vitamins and mineral salts.

2 It is sensible to reduce the intake of carbohydrate foods–bread, potatoes, cake, biscuits, pastry, and all sweet foods. Tinned fruit also has a lot of sugar.

3 Carbohydrates are digested quickly. So you may feel hungry soon after eating sweet foods or starchy foods.

4 Fats take much longer to be digested. After a fatty meal, you may not feel hungry for some time.

5 More exercise may help to use up unwanted fat. Walking 3 or 4 kilometres every day will oxidize about 1 kilogram of fat in a month. Of course, exercise can make you hungry–both regular exercise and watching what you eat are needed to control your mass.

one high-protein missionary coming up!

GLOSSARY

absorbed *(ab-SORBD).* A particle is said to be absorbed if it passes from one side of a surface to the other side of the surface.

alimentary canal *(alli-MEN-tree kan-AL).* A tube that passes through the body from mouth to **anus.**

amino *(a-MY-noe)* **acid.** All amino acids contain **atoms** of carbon, hydrogen, oxygen and nitrogen. Some amino acids also contain one or more atoms of either sulphur or phosphorus. Several amino acids can combine to form **protein.**

anus *(ANE-us).* The opening at the end of the **alimentary canal.**

atom. The smallest part of an **element** that can take part in a **chemical reaction.**

carbohydrate *(kar-boe-HY-drate).* A molecule consisting of **atoms** of carbon, hydrogen and oxygen. Carbohydrates contain twice as many hydrogen atoms as oxygen atoms, e.g. $C_{11}H_{20}O_{10}$.

carbon compounds. Substances containing atoms ~~of carbon and~~ other **elements.** There are an enormous number of different carbon compounds.

chemical reaction. Molecules of at least one substance react to produce molecules of at least one other substance, e.g. carbon + oxygen → carbon dioxide
hydrogen iodide → hydrogen + iodine
carbohydrate + oxygen → → → → carbon dioxide + water

deficiency *(de-FISH-en-see).* Not enough. If a person suffers from a deficiency of, say, vitamin A, it means he is not getting enough vitamin A for normal body activity to be maintained.

dialysis tubing. Tubing made of a membrane that is similar in behaviour to the wall of the alimentary canal.

diet *(DYE-et).* What an animal eats and drinks.

digestion *(dye-JEST-shun).* The process of breaking down food **molecules** into smaller molecules which can pass through the wall of the **alimentary canal.**

DIP. The abbreviation for dichlorophenol indophenol *(dye-CLOR-roe-FEEN-ol IN-doe-FEEN-ol)* is DCPIP, a chemical used to detect the presence of vitamin C. It can simply be called **DIP.**

dissect *(dis-SEKT).* To cut so that the internal parts can be seen.

electron microscope. An instrument that uses beams of electrons (instead of beams of light) to form an image of a very small object. Some electron microscopes can magnify more than 200 000 times.

element *(ELL-a-ment).* Consists of **atoms** of only one type. For example, pure **carbon** is an element; **starch** contains **atoms** of three elements (carbon, hydrogen and oxygen).

enzyme *(EN-zyme).* **Protein** that alters the rates of **chemical reactions.** Most enzymes cause reactions to go much faster.

faeces *(FEE-seez).* What is left in the **alimentary canal** after food has been absorbed.

fat. A **carbon compound** containing **atoms** of hydrogen and oxygen. Fats are solid at ordinary temperature; **oils** are liquid.

glucose *(GLUE-koze).* A sugar with the formula $C_6H_{12}O_6$. It occurs in many plants, and is sometimes called grape sugar.

glycogen *(GLY-koe-jen).* A **carbohydrate** formed of many **glucose molecules** joined together.

gut. See **alimentary canal.**

hepatic portal *(hep-AT-ick PORE-tle)* **system.** A system of vessels that carries blood from the **intestine** to the liver.

intestine *(in-TES-tyne).* That part of the **alimentary canal** between the stomach and the **anus. Digested** food is **absorbed** through the wall of the intestine.

iodine *(EYE-oh-dine)* **solution.** Detects the presence of **starch** by changing colour.

joule *(JOOL).* A measure of energy or heat. One calorie is equivalent to 4.186 joules.

malnutrition *(MAL-new-TRISH-on).* A condition that results if a person does not eat enough of one or more **nutrients** to maintain normal body activities.

Millon's Reagent. Detects the presence of **amino acids** and **proteins** by changing colour.

mineral salt. A compound drawn from the ground by plants and obtained by animals by eating plants. All minerals contain at least one metal **atom,** and in this way are different from other food substances.

molecule *(MOL-eck-yule).* The smallest part of a substance capable of existing by itself. The great majority of molecules consist of two or more **atoms.**

nutrient *(NEW-tree-ent).* Any substance in food that can be **absorbed** through the wall of the **alimentary canal** and that is not harmful to the body. (For example, mercury can be absorbed into the body, but it is poisonous, so is not a nutrient.)

oil. See **fat.**

protein *(PROE-teen).* All proteins consist of **amino acids** combined to form a single large **molecule.**

starch. A substance produced by most plants. A starch **molecule** consists of many **glucose** molecules joined together.

sucrose *(SUE-kroze).* Cane sugar. Its formula is $C_{12}H_{22}O_{11}$.

villus *(VILL-us, plural VILL-ee).* A small projection formed by the wall of the **intestine.**

vitamin *(VY-ta-min).* **Carbon compounds** that are necessary in small amounts for the normal functioning of the body.

FOOD COMPOSITION TABLES

.. indicates lack of information.
0 indicates that the amount present is none or too small to measure.
Tr indicates that traces are known to be present.

FOODS	DESCRIPTIVE MEASURE	Weight in grams	Protein (grams)	Fat (grams)	Carbohydrate (grams)	Calcium (milligrams)	Iron (milligrams)	Vitamin A (micrograms)	Vitamin B_1 (micrograms)	Vitamin B_2 (milligrams)	Niacin (milligrams)	Vitamin C (milligrams)	Energy in kilojoules
MEAT AND POULTRY,													
Beef, corned, boiled	3 slices	75	15.8	21.2	0	9	2.2	..	15	0.13	1.5	0	1109
hamburger	1 patty	75	11.4	14.8	11.9	24	1.7	9	76	0.09	2.3	0	937
meat sauce	2 tablespoons	54	7.6	11.0	1.6	8	1.3	47	41	0.07	1.6	8	575
roast, lean	1 slice	75	20.1	9.2	0	5	4.0	5	69	0.26	3.2	0	706
steak, grilled, lean	1 rump steak	140	39.6	12.3	0	22	6.0	9	109	0.32	8.1	0	1176
casserole with vegetables	¾ cup	170	17.0	19.3	10.0	24	2.8	217	43	1.00	2.3	10	1214
Chicken, boiled, breast, lean	1 breast No. 7 chicken	115	30.2	9.7	0	16	2.2	69	60	0.17	6.9	0	958
fried, leg	1 leg No. 7 chicken	130	37.1	17.0	3.7	20	2.7	62	89	0.44	11.8	0	1378
roasted	2 slices	75	21.8	7.1	0	12	1.6	36	59	0.12	5.9	0	630
Duck, roasted	2 slices	75	17.1	17.7	0	14	4.4	..	60	0.20	4.7	0	987
Lamb, chump, grilled average	2 chops, no bone	110	20.5	33.8	0	11	2.2	..	120	0.20	4.5	0	1638
roast leg	2 slices	75	14.8	23.1	0	5	2.2	Tr	90	0.19	3.8	0	1121
Pork, bacon, fried	1 strip	21	4.1	13.4	0.4	5	0.4	0	83	0.05	0.8	0	596
grilled	1 strip	15	4.1	8.9	0.4	4	0.4	0	76	0.05	0.8	0	416
chops, grilled	1 average	80	17.4	30.4	0	9	2.3	0	581	0.14	3.6	0	1462
ham, cooked	2 slices	60	9.7	21.2	0	6	1.4	0	375	0.12	2.2	0	979
sweet and sour pork	½ cup	110	9.3	36.3	9.4	15	1.5	101	231	0.08	1.9	10	1667
Rabbit, stewed	¾ cup	170	45.2	13.0	3.4	32	3.2	..	73	0.08	15.3	0	1344
Turkey, roasted	2 slices	75	22.0	12.3	0	26	3.8	..	60	0.12	7.4	0	865
Veal, cutlet, crumbed and fried	2 average, no bone	140	27.7	25.6	12.1	27	4.3	..	147	0.32	8.5	0	1680
Brains, crumbed and fried	1 set	140	16.2	29.5	15.5	60	4.3	0	196	0.25	5.0	18	1709
Kidney, sheep, grilled	1 kidney	35	9.3	3.9	Tr	5	4.9	117	135	1.06	3.2	3	315
Liver, floured, fried	1 slice	60	18.5	6.2	8.2	6	8.3	6396	159	2.23	9.2	16	663
Tripe, cooked with parsley sauce	¾ cup	170	16.6	6.4	10.3	86	0.3	68	37	0.25	1.5	2	714
Salami	2 slices	60	13.3	20.4	Tr	7	2.0	..	139	0.03	0.6	0	1012
Sausage, beef, grilled	2	110	16.7	24.3	10.5	14	3.0	..	83	0.14	3.4	0	1424
pork, grilled	2	110	15.9	25.4	15.4	22	2.6	0	470	0.18	2.5	0	1407

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FOODS	DESCRIPTIVE MEASURE	Weight in grams	Protein (grams)	Fat (grams)	Carbohydrate (grams)	Calcium (milligrams)	Iron (milligrams)	Vitamin A (micrograms)	Vitamin B$_1$ (micrograms)	Vitamin B$_2$ (milligrams)	Niacin (milligrams)	Vitamin C (milligrams)	Energy in kilojoules
Chiko roll	1 roll	200	10.0	43.8	57.8	36	1.8	101	144	0.08	2.0	4	2806
Hamburger	Standard breadroll, hamburger and onion	145	15.3	13.2	43.6	22	2.2	10	143	0.14	2.3	0	1491
Hotdog	Breadroll and 1 frankfurt	115	13.0	16.6	29.6	11	1.5	..	179	0.15	2.2	0	1348
Meat pie		163	13.4	32.0	44.9	58	2.1	327	174	2.30	2.4	0	2176
Potato chips	15 pieces	30	1.5	11.9	15.0	10	0.5	..	63	0.02	1.2	4	714
FISH,													
Crab, meat, canned	½ cup flakes	90	15.5	2.2	1.0	41	0.7	..	72	0.07	1.7	..	378
Fish, baked	1 fillet	60	13.4	2.3	0	26	0.5	..	45	0.07	2.3	..	328
crumbed and fried	1 fillet	100	18.4	14.4	11.6	253	1.4	24	60	0.11	2.0	..	1063
fried in batter	1 fillet	100	19.2	13.1	14.3	249	1.3	85	80	0.14	1.6	..	1046
steamed	1 fillet	75	13.4	2.3	0	26	0.5	..	45	0.07	2.3	..	328
Oysters, fresh	1 dozen medium	120	10.4	1.8	4.9	106	6.8	105	180	0.23	2.8	..	344
Prawns, fried in batter	2 to 3 medium	90	18.2	9.7	9.0	65	1.8	..	36	0.07	2.4	..	853
Salmon, canned	½ cup	120	25.8	9.3	0	221	1.3	88	39	0.16	8.5	0	823
Sardines, canned in oil	4 to 5 small	60	12.5	13.4	..	215	2.2	34	18	0.18	3.3	0	718
Tuna, canned in water	½ small tin	90	25.2	0.8	..	14	1.4	..	..	0.09	11.9	..	479
EGGS,													
Eggs, boiled	1 medium	45	5.6	5.2	0.3	24	1.1	128	39	0.13	0.04	0	302
fried	1 medium	48	5.6	9.3	0.3	25	1.1	184	40	0.13	0.04	0	454
omelette, plain	2 medium	100	11.4	22.6	0.8	52	2.2	426	86	0.26	0.08	0	1042
poached	1 medium	45	5.6	5.2	0.3	24	1.1	128	40	0.12	0.03	0	302
scrambled	1 medium	70	6.6	12.4	1.8	63	1.1	226	55	0.18	0.07	Tr	622

FOOD COMPOSITION TABLES

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FOODS	DESCRIPTIVE MEASURE	Weight in grams	Protein (grams)	Fat (grams)	Carbohydrate (grams)	Calcium (milligrams)	Iron (milligrams)	Vitamin A (micrograms)	Vitamin B$_1$ (micrograms)	Vitamin B$_2$ (milligrams)	Niacin (milligrams)	Vitamin C (milligrams)	Energy in kilojoules
NUTS,													
Almonds, roasted and salted	26	30	5.8	17.0	5.6	74	1.2	0	72	0.22	1.0	0	790
Cashewnuts, roasted	15	30	5.4	14.2	8.4	12	1.4	0	168	0.06	0.6	0	722
Coconut, freshmeat	2 pieces (2 x 2 x 1) cm	30	1.0	10.6	4.6	4	0.6	0	16	Tr	0.2	Tr	462
shredded, dry	¼ cup	15	1.0	9.4	4.4	3	0.5	0	6	Tr	0.1	0	424
Peanuts, roasted and salted	36 to 38	30	7.8	14.6	5.8	22	0.8	0	86	0.06	5.0	0	731
Peanut butter	1 tablespoon	21	5.5	9.7	3.4	14	0.5	..	6	0.09	4.2	..	500
Peas, split, boiled	1/3 cup	56	4.5	0.2	11.[illegible]	8	1.0	4	98	0.05	0.5	0	269
Walnuts, shelled	15 halves	30	4.4	19.0	4.5	25	0.7	0	117	0.04	0.3	Tr	806
MILK AND MILK PRODUCTS,													
Butter and **cream**–refer to fat group													
Cheese, cottage, creamed	1 tablespoon	20	2.7	0.8	0.6	19	Tr	10	6	0.05	Tr	0	88
cream cheese	1 tablespoon	19	1.7	6.1	0.6	8	Tr	78	4	0.04	Tr	0	277
grating cheese–													
parmesan cheese	1 taplespoon	9	3.7	2.9	0	109	Tr	38	2	0.07	Tr	0	172
natural cheddar	1 piece (2 x 2 x 2) cm	20	5.2	6.6	0	172	0.2	84	7	0.09	Tr	0	336
Condensed milk, sweetened	1 tablespoon	27	2.5	2.5	14.7	87	Tr	23	25	0.10	Tr	Tr	391
unsweetened	1 tablespoon	21	1.7	1.7	2.2	62	Tr	17	17	0.08	Tr	Tr	134
Dessert, blancmange	½ cup	125	4.0	4.5	20.0	143	0.3	43	54	0.20	0.3	Tr	580
custard, baked with egg	½ cup	130	6.8	6.8	12.9	146	0.7	98	61	0.23	0.1	Tr	596
custard sauce	¼ cup	70	2.4	2.4	8.0	81	0.1	28	28	0.11	0.1	Tr	273
ice-cream, homemade	2 ice-cream scoops	60	4.3	4.3	9.9	145	0.1	41	39	0.18	0.1	1	412
commercial	2 ice-cream scoops	64	3.4	7.1	13.2	90	0.1	74	30	0.13	0.1	1	542
junket	1 serve	100	3.1	3.3	9.0	106	0.1	..	33	0.15	0.1	..	332
Fluid milk, whole	1 cup	230	7.6	8.7	10.5	264	0.2	94	85	0.39	0.2	2	647
Powdered milk, full cream	1 tablespoon	9	2.6	2.4	3.3	87	Tr	24	25	0.10	0.1	Tr	193
Yoghurt, flavoured and fruit	1 carton	235	10.1	8.2	25.6	305	Tr	88	103	0.44	0.2	2	986
plain	1 carton	230	10.1	8.2	13.1	338	Tr	95	115	0.46	0.2	2	639

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FRUIT,													
Apple, raw, whole	1 small	100	0.3	0.3	13.8	6	0.3	7	36	0.03	0.2	6	223
stewed, with added sugar	1 small	115	0.3	0.3	24.4	8	0.3	6	32	0.03	0.2	5	395
canned sweetened	7 pieces with syrup	100	0.2	0.1	20.6	4	0.4	3	20	0.01	Tr	4	319
sauce	1 baby can	127	0.2	0.3	23.5	5	0.5	3	15	0.03	Tr	29	412
Apricot, raw, whole	3 medium	100	0.8	0.2	11.4	16	0.5	245	34	0.05	0.8	8	189
canned, sweetened	4 medium halves	120	0.7	0.1	23.4	12	0.5	181	23	0.02	0.3	6	361
dried, raw	5 halves	25	1.1	0.1	17.1	21	1.1	220	2	0.04	0.8	2	277
Banana, ripe	1 medium peeled	100	1.1	0.3	22.5	9	0.6	33	62	0.05	0.7	11	365
Cherries, raw	20 to 22 medium	100	0.9	0.4	15.1	18	0.4	27	50	0.06	0.4	8	256
Dates, dried	5 to 6 pitted	33	0.7	0.2	25.3	22	0.7	3	28	0.03	0.7	0	399
Grapefruit, raw	½	120	0.6	0.2	11.0	24	0.3	4	53	0.02	0.2	48	185
Grapes, raw	20 to 22	100	0.7	0.4	16.8	18	0.5	8	54	0.04	0.2	4	277
Lemon, raw	2 slices	15	0.1	Tr	1.5	8	0.1	Tr	8	Tr	Tr	7	21
Mandarine, raw	1 large or 2 small	100	0.8	0.3	11.2	37	0.4	46	68	0.03	0.2	31	
Mango, ripe	1 small	100	0.7	0.2	17.2	10	0.3	801	55	0.06	0.9	41	277
Orange	1 medium	130	1.2	0.3	14.4	51	0.5	30	109	0.04	0.3	65	248
Passionfruit, raw	1 medium	30	0.7	0.2	6.3	4	0.4	Tr	0	0.03	0.4	7	113
Pawpaw, raw	¼ medium	100	0.6	0.1	10.5	21	0.3	131	36	0.04	0.3	64	172
Peaches, raw, yellow	1 medium	110	0.7	0.1	11.7	8	0.6	113	22	0.05	1.1	8	189
canned, sweetened	5 pieces with syrup	120	0.4	0.1	22.0	5	0.4	52	12	0.02	0.7	5	344
Pear, raw	1 medium	150	0.6	0.4	21.7	12	0.4	3	33	0.06	0.2	8	353
canned, sweetened	2 halves in syrup	120	0.2	0.1	20.8	8	0.2	2	12	0.02	0.2	8	323
Pineapple, raw	1 slice	80	0.4	0.2	10.8	14	0.3	36	66	0.03	0.2	21	176
canned, sweetened	2 slices	90	0.4	0.1	17.7	17	0.5	7	61	0.02	0.2	8	277
Strawberries, raw	12 to 14 medium	100	0.7	0.5	8.6	24	0.8	8	26	0.06	0.4	58	155
Sultanas, raisins, currants, dried	1 tablespoon	13	0.2	Tr	9.2	9	0.2	1	17	0.01	0.1	Tr	147
Watermelon, raw	½ cup balls	110	0.5	0.2	7.1	7	0.3	65	46	0.04	0.2	6	126
Fruit salad, fresh fruit	½ cup	110	0.9	0.3	17.6	17	0.6	30	68	0.04	0.4	23	290
semi fresh	½ cup	110	0.5	0.2	19.3	10	0.3	25	28	0.03	0.4	10	307
tropical, canned	½ cup	110	0.3	0.1	20.9	9	0.3	51	15	0.03	0.4	2	332

FOOD COMPOSITION TABLES

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FRUIT JUICES,													
Grapefruit, fresh	½ cup	120	0.6	0.1	11.4	11	0.3	0	46	0.02	0.2	47	185
canned	½ cup	120	0.6	0.1	15.3	10	0.3	0	36	0.02	0.2	36	239
Orange, fresh	½ cup	120	0.9	0.3	12.7	38	0.3	36	100	0.03	0.3	59	218
canned	½ cup	120	0.8	0.2	14.6	12	0.4	26	84	0.02	0.3	48	239
Pineapple, canned	½ cup	120	0.5	0.1	15.8	16	0.6	9	60	0.02	0.2	11	248
VEGETABLES,													
Asparagus, canned	3 medium spears	60	1.0	0.2	1.8	12	0.6	31	42	0.05	0.5	9	46
Beans, baked beans	¼ cup	60	3.6	0.3	13.1	25	1.0	5	30	0.02	0.3	1	277
french, boiled	½ cup	60	1.0	0.1	4.0	29	0.4	38	35	0.04	0.2	7	80
Beetroot, canned	2 slices	30	0.3	Tr	2.3	4	0.2	Tr	3	0.01	Tr	1	42
Cabbage, raw, shredded	1/3 cup	35	0.5	0.1	1.9	16	0.2	5	20	0.01	0.1	20	38
Carrots, raw	1 small	60	0.5	0.1	5.1	24	0.4	765	36	0.03	0.3	3	92
boiled	1/3 cup diced	50	0.4	0.1	3.5	8	0.3	583	25	0.03	0.2	2	63
Cauliflower, boiled	½ cup flower pieces	60	1.3	0.1	2.5	12	0.4	3	49	0.05	0.3	31	59
Celery, raw	3 pieces 7 cm long	30	0.3	Tr	1.3	14	0.1	8	11	0.01	0.1	2	25
Corn, canned, sweet	¼ cup	40	0.9	0.3	7.3	2	0.3	16	48	0.02	0.4	2	139
canned, cream style	¼ cup	60	1.2	0.4	12.0	2	0.4	9	18	0.03	0.6	3	206
Lettuce, raw	2 small leaves	20	0.3	Tr	0.6	6	0.1	60	11	0.02	Tr	3	17
Mushrooms, sauteed in butter	6 to 7 small	60	1.4	6.3	2.4	7	0.5	43	48	0.24	2.5	Tr	277
Peas, green, boiled	1/3 cup	56	3.0	0.2	7.6	11	1.0	39	140	0.08	1.1	11	164
Potato, baked	1 medium	90	2.0	9.1	19.7	10	0.7	5	85	0.05	1.1	11	689
boiled	1 medium	90	1.8	0.1	17.1	8	0.6	1	92	0.04	1.0	10	302
fried (salt added)	17 to 18 pieces	90	3.4	12.7	29.3	13	0.9	6	90	0.05	1.5	10	1012
mashed, milk added	1/3 cup	70	1.4	0.5	9.2	16	0.3	3	59	0.04	0.6	6	185
Pumpkin, boiled	¼ cup mashed	60	0.6	0.1	4.2	15	0.3	326	21	0.04	0.3	3	80
Spinach and silverbeet, boiled	1/3 cup	60	1.7	0.2	2.7	65	1.8	615	48	0.10	0.3	15	67
Tomato, raw	1 medium	110	1.1	0.3	4.5	15	0.5	131	66	0.04	0.6	24	97

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CEREALS AND CEREAL PRODUCTS,													
Cracker biscuits, low fat, e.g. Salada	3 biscuits	12	1.3	0.9	8.8	..	..	..	..	..	..	..	202
medium fat, e.g. Sao	2 biscuits	18	1.4	3.3	12.5	..	..	..	..	..	..	..	356
high fat, e.g. cheese crackers	3 biscuits	12	1.0	3.1	7.1	..	..	..	..	..	..	..	248
Crispbread, rye, Ryvita	2 biscuits	19	1.9	0.5	15.0	..	..	..	..	..	..	..	286
wheat, Vita Wheat	2 biscuits	11	1.0	1.2	8.3	5	0.4	..	22	..	..	..	193
Sweet biscuits, cream filled	1 biscuit	19	0.9	4.8	12.8	..	..	..	..	..	..	..	398
plain	2 biscuits	16	1.0	2.0	12.3	7	0.2	..	8	Tr	0.1	0	286
Bread, brown	2 slices	50	4.0	0.9	24.6	10	0.9	0	105	0.06	1.2	0	508
rye, light	2 slices	44	3.3	0.7	21.6	33	0.7	0	76	0.03	0.6	0	440
white	2 slices	46	3.6	0.7	23.0	6	0.5	0	59	0.04	0.4	0	470
white roll, long	17 cm long	66	5.2	1.0	33.2	9	0.7	0	85	0.04	0.6	0	672
white, starch reduced	2 slices	36	3.4	0.9	17.0	5	0.4	0	46	0.03	0.3	0	370
wholemeal	2 slices	64	5.2	1.5	29.9	22	1.9	0	175	0.06	1.7	..	617
Crumpets	one	54	2.9	0.6	20.0	..	..	..	25	0.02	0.2	0	415
Breakfast cereal, branflakes, cornflakes and rice bubbles	1 cup	28	2.4	0.2	23.6	9	2.4	Tr	454	0.66	4.47	..	437
oatmeal, cooked (salt added)	1 cup	234	4.7	2.6	23.4	19	1.4	..	183	0.05	0.2	0	542
wheatflake biscuits	2 biscuits	33	4.2	0.4	24.4	18	1.6	..	162	0.04	1.2	..	504
Flour, white, self raising	1 tablespoon	10	1.1	0.2	7.5	5	0.1	0	22	Tr	0.1	0	151
Macaroni, boiled	1 cup	150	4.9	0.8	34.8	12	0.6	0	45	0.02	0.6	0	718
Noodles, boiled	1 cup	150	6.1	2.0	34.8	12	0.9	23	60	0.03	0.6	0	756
Rice, boiled, salt added	1 cup	160	3.2	0.3	39.0	11	0.3	0	40	0.02	0.6	0	718

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FATS AND OILS,													
Butter, salted	1 tablespoon	19	0.1	15.4	0.1	3	Tr	191	3	Tr	Tr	0	580
Cream, fresh	1 tablespoon	20	0.4	7.6	0.6	16	Tr	100	5	0.02	Tr	Tr	307
Margarine, table	1 tablespoon	19	0.1	15.4	0.1	4	Tr	123	..	..	..	..	580
Oil, salad and cooking	1 tablespoon	19	..	18.9	..	..	..	..	..	..	..	..	706
Peanut butter	1 tablespoon	21	5.5	9.7	3.4	14	0.5	..	6	0.09	4.2	..	500
Salad dressings, french dressing	1 tablespoon	20	0.1	7.4	3.7	2	0.1	..	..	..	..	..	340
mayonnaise	1 tablespoon	19	0.2	15.0	0.5	3	0.1	5	4	Tr	Tr	0	568
BEVERAGES,													
Carbonated, (e.g. Coca Cola)	½ small bottle	170	0	0	20.4	0	0	0	0	0	0	0	323
Chocolate, malted milk shake	1 regular	345	12.1	13.4	38.1	389	0.9	133	269	..	..	3	1365
milk shake	1 regular	335	10.9	12.6	31.6	359	0.9	133	124	0.92	0.4	3	1205
Thick milk shake, flavoured	1 regular	345	11.6	15.0	27.4	390	0.3	161	126	0.57	0.3	3	1231
Coffee, with milk	1 cup	..	..	..	..	..	..	..	..	..	..	..	126
Lemonade	1 glass	230	0.2	Tr	25.7	2	Tr	0	16	0.02	0.2	16	407
Milo, made with milk	1 glass	230	8.7	9.8	17.0	322	2.3	105	285	..	..	..	773
Ovaltine, made with water	1 glass	240	2.0	0.8	9.8	38	2.6	48	246	0.16	3.2	6	227
Tea, with milk	1 cup	..	..	..	..	..	..	..	..	..	..	..	26
CAKES AND PUDDINGS,													
Bun, plain sweet	1 average	50	3.1	4.8	25.6	27	0.9	21	85	0.09	0.8	0	664
Cheese cake	1/6 of 14 cm cake	120	10.2	21.1	27.9	85	0.6	250	41	0.19	0.1	Tr	1432
Doughnut, cake type	1 average	40	2.6	7.0	20.0	14	0.5	92	48	0.04	0.2	Tr	592
Fruit cake, light	1 slice	33	2.0	6.0	18.1	16	0.4	69	37	0.03	0.2	Tr	538
Jelly	1 serve	100	2.9	0	21.8	..	..	..	..	..	..	..	407
Lamington	1 piece	60	3.8	7.8	33.5	20	1.2	40	40	0.06	0.1	Tr	898
Pie, fruit	1/6 of 14 cm pie	140	3.3	12.4	52.6	8	0.4	..	28	0.22	0.4	Tr	1386
Scones, plain	1 scone	30	2.9	3.3	16.3	41	0.3	46	52	0.04	0.3	0	445
Sponge cake, plain	1 slice	30	2.8	1.8	16.5	17	0.5	41	35	0.05	0.1	..	395
fresh cream, iced	1 slice	50	2.9	5.2	23.7	23	0.5	84	37	0.06	0.2	..	638

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CONFECTIONERY,													
Boiled sweets	1 average piece	8	Tr	Tr	7.3	Tr	Tr	..	..	..	..	0	118
Chocolate, block milk	4 to 6 small squares	20	1.8	6.2	11.2	59	0.4	10	24	0.08	0.1	0	454
nut milk	4 to 6 small squares	20	2.8	7.6	8.9	35	0.3	..	50	0.05	1.0	0	458
plain dark	4 to 6 small squares	20	0.8	6.0	12.5	7	..	4	18	0.03	0.1	0	487
SANDWICHES,													
White bread, no filling	2 slices and butter	60	4.4	8.6	28.3	8	0.6	190	76	0.04	0.5	0	889
plus baked beans	1 tablespoon	20	1.2	0.1	4.4	8	0.3	2	10	0.01	0.1	[illegible]	92
plus cheese	1 slice (packet)	21	4.6	5.3	0.2	132	0.2	67	4	0.10	Tr	0	281
plus egg	½ egg	22	2.8	2.6	0.1	12	0.6	62	20	0.06	Tr	0	151
plus ham	1 slice	22	13.7	9.2	Tr	8	2.0	..	398	0.14	2.9	0	609
plus meat	1 slice	25	7.3	2.4	0	4	0.6	..	20	0.04	2.0	0	210
plus peanut butter	1 tablespoon	21	5.5	9.7	3.4	14	0.5	..	6	0.09	4.2	0	500
plus salad	lettuce, beetroot, cucumber, tomato	45	0.2	Tr	2.3	5	0.2	47	16	0.01	Tr	5	50
plus tomato	2 thin slices	13	Tr	Tr	0.5	2	0.1	16	8	Tr	0.1	3	13
SAUCES,													
Gravy, home made	2 tablespoons	45	0.4	5.1	6.3	47	0.3	64	18	0.01	0.1	5	307
Tomato ketchup and sauce	1 tablespoon	21	0.4	0.1	5.1	4	0.2	48	19	0.01	0.4	3	88
SOUPS,													
Canned,													
chicken, cream of	1 cup	230	3.7	5.3	7.4	44	0.6	138	23	0.12	0.4	..	386
split pea, with ham	1 cup	230	8.7	3.7	27.4	23	3.3	32	138	0.09	1.1	..	743
tomato, cream of	1 cup	230	1.3	2.3	15.3	30	0.7	65	46	0.07	0.5	..	365
vegetable	1 cup	230	3.5	1.8	11.5	17	1.0	276	23	0.03	0.6	..	319
Dried mix,													
asparagus	1 cup	230	1.2	1.1	7.4	..	..	..	..	..	..	..	193
chicken noodle	1 cup	230	1.7	0.6	7.3	..	..	..	..	..	..	..	130
mushroom	1 cup	230	1.2	1.7	6.6	..	..	..	..	..	..	..	202
tomato	1 cup	230	0.9	Tr	9.5	..	..	..	..	..	..	..	172

FOOD COMPOSITION TABLES

.. indicates lack of information.
0 indicates that the amount present is none or too small to measure.
Tr indicates that traces are known to be present.

FOODS	DESCRIPTIVE MEASURE	Weight in grams	Protein (grams)	Fat (grams)	Carbohydrate (grams)	Calcium (milligrams)	Iron (milligrams)	Vitamin A (micrograms)	Vitamin B_1 (micrograms)	Vitamin B_2 (milligrams)	Niacin (milligrams)	Vitamin C (milligrams)	Energy in kilojoules
SUGAR AND SPREADS,													
Vegemite	½ teaspoon	3	0.8	0	0.3	3	..	..	291	0.42	2.91	..	17
Honey	1 tablespoon	27	0.1	..	21.6	2	0.2	0	8	Tr	Tr	Tr	365
Jams and other preserves	1 tablespoon	27	Tr	Tr	17.9	5	0.2	0	1	Tr	Tr	1	298
Sugar, refined	1 tablespoon	16	0	0	16.0	Tr	Tr	0	0	0	0	0	260
brown	1 tablespoon	19	0	0	17.8	19	0.2	0	0	0	0	0	294

These tables have been adapted from:
Corden, M. and Thomas, S. *Simplified Food Composition Tables.*
Canberra, Commonwealth Department of Health, Nutrition Section, 1971.

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